RADIOLOGY

MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

Volume 32

January—June, 1939

Owned and Published by

THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

As Its Official Journal

610.5
R118
v.32

SEP 13 1939
435162
B.P.

Copyrighted 1939, by the
Radiological Society of North America, Inc.

PLYMOUTH
COLLEGE
LIBRARY

INDEX TO VOLUME 32
SUBJECTS[1]

ABDOMEN
Abdominal roentgenography, Use of prostigmin as preparation for (ab.), M. J. Farrell, Jan., 123.
Diagnosis of unusual calcareous shadows found on x-ray films of abdomen, C. B. Rose, May, 600.
Retroperitoneal cyst with agenesia of kidney, K. Kornblum and J. A. Ritter, April, 416.

ABNORMALITIES AND DEFORMITIES
Hip joint in children, Deformities of (ab.), C. G. Teall, March, 374.
Os centrale of wrist (ab.), R. O. Tanguy, March, 390.
Vertebral articular apophyses, Anomalies of (ab.), F. Willemin and M. Cantagrill, April, 517.

ACROCEPHALY
Pneumatization of facial bones in Crouzon's disease, Apert's disease, and oxycephaly (ab.), P. de Gunten, March, 384.

ADAMANTINOMA. *See* **Tumors, adamantinoma.**

ADENOMA. *See* **Tumors, adenoma.**

ADOLESCENCE
Adolescent tibia vara, J. A. Siegling and J. B. Gillespie, April, 483.
Heart at puberty, Size, variability, and correlation of (ab.), G. Marzocchi, Feb., 259.
Hypogonadism, Bone changes in primary, L. M. Hurxthal and H. F. Hare, May, 521.

AMEBIASIS
Amebic infections of large bowel, Further consideration of roentgen-ray manifestations in, J. C. Bell, March, 332.
Chronic intestinal amebiasis, Diagnosis of (ab.), M. Poirot, March, 376.

ANEMIA
Dysphagia, Hysterical: report of case (ab.), H. W. Schmidt, Feb., 256.
Stenoses and false stenoses of intestine in course of grave anemias (ab.), J.-C. Roux and J. Mialaret, Jan., 117.
Thalassanemia (ab.), E. S. Mills, May, 646.

ANESTHESIA
Cyclopropane anesthesia, Massive atelectasis following: report of cases and theory of cause and prevention (ab.), O. R. Jones and G. E. Burford, March, 378.

ANEURYSM
Aneurysm, Clinical aspects of (ab.), J. H. Mills and B. T. Horton, June, 746.
Aneurysm of heart wall, Instructive case of, with "teeter-movement" symptom (ab.), L. Bischoff, June, 746.
Dissecting aneurysm of aorta: clinical recognition (ab.), A. J. Patek, April, 509.
Paraplegia from erosion of vertebral column by large thoracic aneurysm, M. J. Hubeny and P. J. Delano, Feb., 171.
Radiology in elucidation of hemoptysis, Value of (ab.), F. G. Wood, March, 378.
Roentgen kymographic studies of aneurysms and mediastinal tumors (ab.), W. G. Scott and S. Moore, March, 377.
Saccular aneurysms of internal carotid artery in cavernous sinus (ab.), G. Jefferson, April, 508.

ANGINA
Primary tuberculous angina, Diagnostic value of pulmonary radiography in: insufficiency of radioscopy (ab.), L. Weigel, May, 633.

ANGIOMAS. *See* **Tumors.**

ANIMAL EXPERIMENTATION
Body weight, Influence of ultra-violet rays on, F. Ellinger, Feb., 157.
Change of environments of animal cells on their radiosensitivity, Experimental study on effect of (ab.), Y. Kagami, April, 501.
Disc. by C. B. Peirce of "Bone changes in primary hypogonadism," L. M. Hurxthal and H. F. Hare, May, 527.
Experimental production of sarcoma with radium and mesothorium (ab.), E. Uehlinger and O. Schürch, March, 383.
Irradiation of reticulo-endothelial tissue with small doses of roentgen rays, Studies on (ab.), S. A. Chrom, April, 501.
Malignant cells, Further study on direct and indirect actions of radiation on: I.—Transplantation of tissue cultures of Mouse Sarcoma 180 after exposure to roentgen rays: I.—Cultures of tumors irradiated *in vivo*, K. Sugiura and I. Cohen, Jan., 71.
Neurological tumors, Some experiences, experimental and clinical, with direct irradiation of, during operation with low voltage radiation, J. R. Carty and B. S. Ray, March, 325 (326).
Radiation therapy and glands of internal secretion (ed.), March, 360.
Radio-active substances, Danger of introducing, into body of mammals: experience with two mares (ab.), T. Nogier, May, 642.
Radiographic studies of excretion of dusts from lungs (ab.), A. E. Barclay, K. J. Franklin, and R. G. Macbeth, May, 635.
Roentgen therapy of carefully selected sinus infections, F. M. Hodges and L. O. Snead, June, 669.
Soluble radium, injected into animal, distributed in various body tissue, How is? (ab.), F. Daels, March, 383.
Stomach, Influence of pituitrin on evacuation of (ab.), R. I. Levina, Jan., 126.

ANTRUM
Osteoma of maxillary sinus (ab.), A. G. Rawlins, March, 384.

ANUS
Hemorrhoids and ano-rectal angiomas in infants (ab.), A. Bensaude and F. Bertillon, Jan., 123.

AORTA
Aneurysm of aorta, Dissecting: clinical recognition (ab.), A. J. Patek, April, 509.
Calcified aortic stenosis, Isolated (ab.), W. F. Friedewald and A. R. Ewing, Feb., 259.
Paraplegia from erosion of vertebral column by large thoracic aneurysm, M. J. Hubeny and P. J. Delano, Feb., 171.

APPARATUS
Biotome of Bocage and of planigraph of Ziedses des Plantes, Presentation of (ab.), J. Massiot, June, 747.
Biotome: presentation of apparatus (ab.), M. A. Bocage, Feb., 247.
Bocage, Presentation of several pulmonary "biotomes" taken with apparatus of (ab.), Léon-Kindberg and L. Gérard, Feb., 247.
Cold screening in low-power radiography (ab.), S. T. Li, April, 501.
Dosage measurements by simple computations, H. M. Parker, May, 591.
Dosimetric and radiobiologic experiments with fast neutrons.—I. (ab.), K. G. Zimmer, April, 504.
Electrostatic generator operating under high air pressure—operational experience and accessory apparatus (ab.), D. B. Parkinson, R. G. Herb, E. J. Bernet, and J. L. McKibben, Feb., 248.
Exhibition rack, Convenient lantern-slide, V. Mooney, April, 476.
Geiger-Müller counter: recent instrument in medicine and medical research (ab.), M. L. Weinstein and L. Rovner, April, 501.
Greinacher "spark" counter for measurement of very small quantities of roentgen and radium rays (ab.), A. Leichti, Feb., 248.
High milliamperage and high voltage apparatus for roentgen deep therapy, Modern (ab.), W. Fehr, June, 746.
Historadiography (ab.), P. Lamarque, April, 501.
Ionization chambers, Dependence of ionization current on volume of small (ab.), U. Henschke, Feb., 247.
Measurement of tissue dosage in radiation therapy, E. H. Quimby, May, 583.
Miniature photographs from roentgen screen, Standing and prospects of (ab.), H. Holfelder and F. Berner, June, 746.
Mobile x-ray apparatus, Roentgen treatment of acute peritonitis and other infections with, J. A. Kelly and D. A. Dowell, June, 675.
Near-distance x-ray tubes and body cavity tubes of various constructions, Distribution of dose in (ab.), T. Zimmer, June, 747.
Neutron production and production of artificial radioactivity, Technic of (ab.), A. Bouwers, April, 501.
Planigraphy—application to thoracic diagnosis, W. E. Howes, May, 556.
Planigraphy with mathematical instruments, Computation of dimensions in, D. H. Drummond and W. W. Schmela, May, 550.
Radiographic teaching models, Two (ab.), W. E. Boyd, June, 746.
Radiography of optic canal, Simple procedure for (ab.), A. Bardy, Feb., 248.
Roentgen therapy by method of Chaoul, E. P. Pendergrass, P. J. Hodes, and C. J. Garrahan, Feb., 142.
Roentgenographic pelvimetry and fetalometry: elimination of errors due to movements between x-ray exposures, W. W. Fray and W. T. Pommerenke, March, 261.
Scattering and photo-electric absorption of high voltage x-rays in nitrogen (ab.), H. C. Trueblood and D. H. Loughridge, May, 637.
Stratigraphy of lungs and bones (ab.), Delaborde, June, 746.
Stratigraphy, Practical pulmonary (ab.), C. Gaillard, June, 747.
Table for use in radiography of infants' chests, H. Geissberger, Jan., 96.
Targets in cyclotron, Internal (ab.), R. R. Wilson and M. D. Kamen, June, 747.
Thimble ionization chamber, Note on use of clinical dosage meters using, M. C. Reinhard, March, 282.
Tube actuated by Van de Graaf generator, Physical measurements on roentgen radiation from, J. C. Hudson, May, 530.
Tubes, Effect of cable length on radiation output of shockproof x-ray, T. H. Rogers, Feb., 202.

[1] A number in parentheses following the folio indicates that on that page is to be found a special reference to the indexed subject.

APPARATUS—*Continued*
Tube, Experiments with condenser discharge x-ray (ab.), K. H. Kingdon and H. E. Tanis, Jr., Feb., 247.
Tubes, Five years' experience of modern shock-proof and ray-proof containers for roentgen therapy (ab.), R. Thoraeus, Feb., 247.
Tube rail for general diagnostic x-ray laboratory, Ceiling mounted, C. J. Zintheo, April, 477.
Visualization of sinus tracts, Simple apparatus for, L. Long, June, 733.
X-ray apparatus, Problem of "high current" (ab.), C. H. Esser and P. Ott, Feb., 248.
X-ray tube with pointed anode, New Siemens body cavity (ab.), Zimmer, Feb., 247.
APPENDIX
Calcified fecalith in appendix: report of case of acute suppurative appendicitis perforated by calcified fecalith (ab.), H. J. Shelley, April, 502.
Chronic appendicitis and x-ray study (ab.), H. Lossen, April, 501.
Lipiodol in treatment of persistent fecal fistula after appendectomy (ab.), S. N. Mendelsohn and L. H. Schriver, April, 501.
ARTERIES
Aneurysms of internal carotid artery in cavernous sinus, Saccular (ab.), G. Jefferson, April, 508.
ARTERIOGRAPHY
Carcinoma of thymus, with marked pulmonary osteoarthropathy, E. R. Miller, June, 651 (658).
X-ray inquiry into genesis of current of venous blood and lymph, K. Mayer, March, 275.
ARTHRITIS
Acute arthritis developing in hip joint presenting lesions of post-traumatic coxarthritis (ab.), Lamarque and Bétoulières, March, 374.
Acute infectious arthritis, New surgical procedure in (ab.), H. E. Hipps, Feb., 248.
Chronic arthritis, Massive doses of vitamin D in: effect on calcium metabolism (ab.), C. L. Steinberg, March, 366.
Shoulder, Chronic arthritis of (ab.), J. G. Kuhns, Feb., 248.
gonorrheal
Gonococcal infections, Fever therapy in, W. Bierman and C. L. Levenson, April, 454 (458).
ARTHRITIS DEFORMANS
Chauffard-Still's disease, Treatment of (ab.), F. LePennetier, March, 385.
ASBESTOSIS
Asbestosis (ab.), J. V. Sparkes, June, 747. *See also* **Pneumoconiosis.**
ASTHMA
Bronchial asthma, Roentgen studies of pathological physiology of (ab.), L. G. Rigler and R. Koucky, June, 748.
ATELECTASIS
Acute and chronic atelectases of lungs and their sequences (ab.), R. Pohl, March, 379.
Massive atelectasis following cyclopropane anesthesia: report of cases and theory of cause and prevention (ab.), O. R. Jones and G. E. Burford, March, 378.
ATLAS AND AXIS
Fracture of atlas in automobile accidents: value of x-ray views for diagnosis (ab.), H. F. Plaut, March, 372.
Fracture of odontoid, Three cases of injury to cervical spine, including one of unrecognized (ab.), Brillouet and A. Viel, March, 372.
AZOTEMIA. *See* **Blood nitrogen.**

BACKACHE
Back pain and sciatica, Displacement of intervertebral cartilage as cause of (ab.), E. F. Fincher and E. B. Walker, March, 366.
Hypertrophy of ligamentum flavum as factor in production of low back and sciatic pain (ab.), W. D. Abbott, March, 366.
Low back and sciatic pain, Intractable, due to protruded intervertebral disks: diagnosis and treatment (ab.), J. G. Love, June, 748.
Low back pain in relation to urology (ab.), S. F. Wildman, June, 748.
Low backache, Lumbosacral anomalies as cause of (ab.), W. Clarkson and A. Barker, June, 748.
Lower back, Orthopedic aspects of pain in (ab.), L. W. Breck, Feb., 249.
BACTERIA
Brucella melitensis, Vertebral osteo-arthritis due to (ab.), H. Duclos, April, 517.
BILIARY TRACT
Calculi, Differential diagnosis of biliary and urinary (ab.), H. Pons, June, 751.
Carcinoma of biliary system, Primary: clinico-pathological analysis of 40 cases (ab.), R. D'Aunoy, M. A. Ogden, and B. Halpert, March, 369.
Common duct stones, Non-operative management of remaining (ab.), R. R. Best and N. F. Hicken, Feb., 250.
Gallstones, Formation of transparent gas-filled fissures in, and their significance for radiological diagnosis (ab.), Å. Åkerlund, June, 751.
Hepatic complications in polycythemia vera (ab.), A. R. Sohval, April, 511.
Pyogenic liver abscess (ab.), E. L. Eliason, R. B. Brown, and D. P. Anderson, April, 511.

BIOGRAPHY
Taylor, Raymond Griswold: appreciation, L. H. Garland, Jan., 108.
BIOLOGICAL EXPERIMENTATION
Dosimetric and radiobiologic experiments with fast neutrons.—II. (ab.), K. G. Zimmer and N. W. Timofeeff-Ressovsky, April, 504.
Low temperature on recovery from roentgen rays, Influence of, E. V. Cook, March, 289.
Mitogenetic radiation, Present status of, A. Hollaender, April, 404.
Radiobiological experiments with pupæ of *Drosophila* (ab.), A. Liechti, W. Minder, and J. H. Müller, April, 502.
Radiosensitivity and cell division (ab.), W. Luther, Feb., 249.
Radiosensitivity and recurrent growth in *Obelia*, P. S. Henshaw, April, 466.
Roentgen rays, Biologic effect of (ab.), J. A. Crowther, Feb., 249.
BIOPSY
Carcinoma of breast, Value of radiation in treatment of, L. G. Allen, Jan., 63 (66).
Tumor variants and their influence upon radiosensitivity, Some histological, I. A. B. Cathie, April, 425 (426).
BLADDER
Calculus of bladder in case previously treated for cancer of cervix (ab.), T. Nogier, March, 369.
Carcinoma, bladder, Radium therapy of: five-year results, failures, and future therapy (ab.), B. S. Barringer, May, 641.
Dermoid cyst of bladder (ab.), A. Lidzki, June, 749.
Injurious effects on bladder, Avoidance of, in radiation therapy of carcinoma of uterus (ab.), T. C. Neeff and F. Hoff, June, 749.
Tumors, Radiological diagnosis of bladder (ab.), W. Sitkowski, June, 749.
BLOOD
Hemophilia, Joint changes in, N. B. Newcomer, May, 573.
Injury of blood in consequence of teleroentgen therapy of whole body, Serious (ab.), D. den Hoed, B. Levie, and M. Straub, March, 386.
Polycythemia, Course of (ab.), N. Rosenthal and F. A. Bassen, April, 502.
circulation
Circulation in pericardial effusion, Studies of (ab.), H. J. Stewart, N. F. Crane, and J. E. Deitrick, March, 373.
X-ray inquiry into genesis of current of venous blood and lymph, K. Mayer, March, 275.
nitrogen
"Azotemic lung": radiographic study (ab.), C. Roubier, May, 634.
BLOOD PRESSURE, high
Essential hypertension, Effects of pentothal sodium on electrocardiogram of patients with (ab.), C. J. Betlach, Jan., 128.
BODY, weight
Ultra-violet rays on body weight, Influence of, F. Ellinger, Feb., 157.
BONES
Osteo-arthropathy, with marked pulmonary, Carcinoma of thymus, E. R. Miller, June, 651.
Stratigraphy of lungs and bones (ab.), Delaborde, June, 746.
Syphilis of bones and joints (ab.), F. A. Jostes and M. B. Roche, May, 645.
diseases
Arthritis, New surgical procedure in acute infectious (ab.), H. E. Hipps, Feb., 248.
Arthritis of shoulder, Chronic (ab.), J. G. Kuhns, Feb., 248.
Bone tuberculosis, Unusual manifestations of, B. P. Widmann, H. W. Ostrum, and R. F. Miller, April, 434.
Brodie's abscess and differential diagnosis (ab.), J. F. Brailsford, Feb., 249.
Cystic enlargement of mandible in Senegalese, Diffuse (ab.), Castay, April, 502.
Deformities of hip joint in children (ab.), C. G. Teall, March, 374.
Frontal hyperostosis syndrome (ab.), H. M. Salzer, April, 503.
Hemangioma involving bones of extremities, Primary (ab.), C. F. Geschickter and I. H. Maseritz, Feb., 250.
Hodgkin's disease of bones (ab.), H. S. Lieberman, March, 367.
Lower jaw of Senegalese, Puffy and cystic appearance of (ab.), Castay, Feb., 249.
Luetic osteitis simulating malignant disease (ab.), A. H. Ungerman, W. H. Vicary, and W. W. Eldridge, April, 517.
Osseous-cartilaginous growth, Rare disturbances of (ab.), F. Holldack, March, 366.
Osseous dystrophy of von Recklinghausen type (ab.), M. Deluen, March, 367.
Osteoperiostitis associated with hypertrophy of palpebral tarsi, skin of face and extremities, Radiologic aspects of almost total: new syndrome (ab.), J. N. Roy and A. Jutras, April, 502.
Osteoporosis in hyperthyroidism (ab.), E. C. Bartels and G. E. Haggart, Feb., 249.
Osteoporosis, Roentgen therapy in acute (ab.), E. B .Mumford, March, 367.

Paget's disease of bone, Roentgen therapy of (ab.), R. Ledoux-Lebard, March, 367.
Paget's disease with diffuse involvement of small bones of extremities, Generalized form of (ab.), P. Harvier, J. Mallarmé, and G. Ledoux-Lebard, Feb., 250.
Pathologic fractures (ab.), R. K. Ghormley, C. G. Sutherland, and G. A. Pollock, Feb., 258.
Petrous tip suppuration: report of three cases, Some observations on (ab.), D. E. S. Wishart, Feb., 256.
Pneumatization of facial bones in Crouzon's disease, Apert's disease, and oxycephaly (ab.), P. de Gunten, March, 384.
Sarcoidosis: report of case (ab.), W. B. Blanton, March, 367.
Sarcoma of left coxofemoral region, Voluminous osteogenic (ab.), Carteret, Dillenseger, and P. Bertrand, May, 643.
Syphilis, Roentgenological manifestations in bone (ab.), D. M. Stewart, April, 518.
Tumor of bone, Giant-cell (ab.), B. L. Coley and N. L. Higinbotham, March, 367.

fragility
Osteogenesis imperfecta tarda, J. F. Lutz and L. C. Pusch, April, 391.

marrow
Polycythemia, Course of (ab.), N. Rosenthal and F. A. Bassen, April, 502.

tumors
Adamantinoma of tibia (ab.), B. Wolfort and D. Sloane, March, 389.
Benign giant-cell tumor of bone, Roentgen diagnosis and treatment of (ab.), J. A. Meadows and K. F. Kesmodel, March, 367.
Bone tumors (ab.), C. A. Hellwig and C. H. Warfield, March, 368.
Bone tumors (ab.), G. J. McChesney, R. L. Carroll, and K. S. Davis, March, 368.
Giant-cell tumor ("osteoclastoma") of femur treated with x-rays (ab.), S. Dechambre, E. Dechambre, and J. Nebout, May, 648.
Intracranial tumors, Bony (ab.), C. Pilcher, May, 647.
Radiosensitivity of Ewing's tumor (ab.), G.-C. Leclerc, May, 648.
Sarcoma, Results of treatment of osteogenic (ab.), H. W. Meyerding, March, 388.
X-ray in general practice, Value of (ab.), C. G. Sutherland, May, 646.

BOOKS, received and reviewed
Abramowitsch, D., *with* Neoussikine, B., jt. auth.
de Andrade, Geraldo, and Lins, Aguinaldo, Diagnosis of Aneurysms of Thoracic Aorta (rev.), Feb., 241.
Appleton, Arthur B., Hamilton, William J., and Tchaperoff, Ivan C. C., Surface and Radiological Anatomy (rev.), May, 628.
Baclesse, F., Radiologic Diagnosis of Malignant Tumors of Pharynx and Larynx: Radiographic and Topographic-anatomical Study (rev.), May, 626.
Bierman, William, Medical Application of Short Wave Current (rev.), Feb., 243.
Brednow, Walter, Roentgen Atlas of Diseases of Heart and Vessels (rec.), June, 744.
Delario, A. J., Handbook of Roentgen and Radium Therapy (rev.), Feb., 242.
Delherm, L., and La Querriere, A., Treatise on Electroradiography (rev.), Feb., 244.
Donaldson, Samuel W., Roentgenologist in Court (rev.) May, 627.
Dyes, Otto, Deformities of Ventricles of Brain Associated with Brain Tumor (rev.), May, 627.
Feldman, Maurice, Clinical Roentgenology of Digestive Tract (rev.), May, 626.
Ferguson, A. B., Roentgen Diagnosis of Extremities and Spine (rec.), April, 495.
Firor, Whitmer, B., *with* Waters, Charles A., jt. ed.
Freeman, Ira M., in collaboration with Haas, Arthur E.
Haas, Arthur E., with collaboration of Freeman, Ira M., Elementary Survey of Physics (rev.), May, 628.
Hamilton, William J., *with* Appleton, Arthur B., jt. auth.
Janker, Robert, Photography of Screen Image: Method of Serial Roentgen Examination (rec.), April, 496.
Jönsson, Gunnar, Malignant Tumors of Skeletal Muscles, Fasciæ, Joint Capsules, Tendon Sheaths, and Serous Bursæ (rev.), Jan., 114.
Jordan, Henry H., Orthopedic Appliances—Principles and Practice of Brace Construction for Use of Orthopedic Surgeons and Brace Makers (rec.), Feb., 241; (rev.), April, 496.
Kaplan, Ira A., *with* Waters, Charles A., jt. ed.
Kienböck, Robert, Roentgen Diagnosis of Diseases of Bones and Joints (rev.), Feb., 241.
Lanza, A. J. (ed.), Silicosis and Asbestosis (rec.), Feb., 241.
La Querriere, A., *with* Delherm, L., jt. auth.
Le Go, Pierre, *with* Richet, Charles, jt. auth.
Lins, Aguinaldo, *with* de Andrade, Geraldo, jt. auth.
Morton, Dudley J., Oh, Doctor, My Feet! (rec.), April, 496; (rev.) May, 626.
Neoussikine, B., and Abramowitsch, D., Electrodiagnosis (rec.), June, 744.
Richet, Charles, Surmont, Jean, and Le Go, Pierre, Fever Therapy (rev.), Feb., 243.
Rigler, Leo G., Outline of Roentgen Diagnosis: An Orientation in the Basic Principles of Diagnosis by the Roentgen Method (rev.), March, 362.
Schliephake, E., Short Wave Therapy (rev.), Feb., 243.
Simons, Edwin J., Primary Carcinoma of Lung (rev.), Feb., 242.
Stieböck, L. H., Practice and Results with Short Wave Treatment Methods in Diseases Resistant to General Therapeutic Methods (rev.), Feb., 244.
Surmont, Jean, *with* Richet, Charles, jt. auth.
Tchaperoff, Ivan C. C., *with* Appleton, Arthur B., jt. auth.
Waters, Charles A., Firor, Whitmer B., and Kaplan, Ira A. (eds.), 1938 Year Book of Radiology (rev.), April, 496.

BRAIN
Neurological tumors, Some experiences, experimental and clinical, with direct irradiation of, during operation with low voltage radiation, J. R. Carty and B. S. Ray, March, 325.

tumors
Anterior basal meningiomas (ab.), W. R. Henderson, Jan., 128.

BREAST
Adipose tissue, Roentgen diagnostic importance of, J. Silbermann, Jan., 77 (83).
Breast lesions by means of contrast media, Roentgen visualization and diagnosis of (ab.), N. F. Hicken, R. R. Best, H. B. Hunt, and T. T. Harris, March, 368.
Calcifications in breast, Extensive (ab.), A. Kubat, March, 368.
Cancer of breast, Technic of x-ray treatment of operable, based upon analysis of Keynes' radium technic, J. R. Andrews, March, 294.
Carcinoma of breast treated by teleroentgentherapy, Vertebral metastasis from (ab.), A. Poulain, Feb., 250.
Carcinoma of breast, Treatment of: technic, complications, and results, E. Newcomer, Feb., 161.
Carcinoma of breast, Value of radiation in treatment of, L. G. Allen, Jan., 63.
Carcinoma of cervix and breast: prognosis and preferable therapy (ab.), E. D. Greenberger, March, 370.
Mammography by contrast media, Limitations and dangers of (ab.), S. A. Romano and E. M. McFetridge, April, 504.
Mammography, Studies in evaluation of (ab.), R. A. Reis and S. D. Mesirow, April, 504.
Mastitis and breast cancer, Chronic: family history of five sisters (ab.), W. S. Hadley, Feb., 250.
Normal breast, Roentgenologic examination of: evaluation in demonstrating early neoplastic changes (ab.), J. Gershon-Cohen and A. Strickler, March, 368.

BRODIE'S ABSCESS. *See* **Bones, diseases.**

BRONCHI
Anatomy of bronchial tree and clinical application (ab.), J. H. Neil, W. Gilmour, F. J. Gwynne, W. Main, and W. A. Fairclough, June, 750.
Asthma, Roentgen studies of pathological physiology of bronchial (ab.), L. G. Rigler and R. Koucky, June, 748.
Bronchiectasis, Further experience with roentgen therapy for, M. Berck and W. Harris, June, 693.
Bronchogenic carcinoma from pathologic and radiologic points of view, Primary (ab.), W. L. Mattick and E. M. Burke, Feb., 252.
Bronchogenic carcinoma: study of eight autopsied cases, W. E. Howes and S. G. Schenck, Jan., 8.
Bronchographic observation of re-expanded lungs following artificial pneumothorax (ab.), G. Zorzoli, May, 638.
Bronchostenosis: roentgenological study (ab.), N. Westermark, June, 750.
Carcinoma of bronchus, Primary (ab.), I. H. Lockwood, June, 752.
Segments in right upper lobe, Division of lung (ab.), E. Behr and E. Huizinga, May, 635.

BRONCHIECTASIS
Carcinoma of lung, Roentgenographic images in primary, L. A. Hochberg, June, 713 (721).
Lobectomy, Bilateral, for bronchiectasis (ab.), D. E. Ross, June, 750.
Radiology in elucidation of hemoptysis, Value of (ab.), F. G. Wood, March, 378.
Roentgen therapy for bronchiectasis, Further experience with, M. Berck and W. Harris, June, 693.
Stenosis, Rôle of inflammatory bronchial, in etiology of bronchiectasis (ab.), P. H. Holinger, June, 749.
Thoracic diagnosis, Planigraphy—its application to, W. E. Howes, May, 556 (561).

BRONCHOPNEUMONIA
Bronchopneumonia, Delayed resolution in (ab.), F. N. Cole, March, 382.
Lobar pneumonia, Roentgen therapy of (ab.), E. V. Powell, March, 382.

BRONCHOSCOPY
Bronchoscopy and esophagoscopy of importance in general practice, Phases of (ab.), V. J. Schwartz, Feb., 250.

BURSA
Calcification of bursa of coracoclavicular ligament (ab.), H. J. McCurrich, April, 503.
Cystic hygroma of neck (ab.), B. L. Fleming, Jan., 129.

CALCANEUM
Arthritis, New surgical procedure in acute infectious (ab.), H. E. Hipps, Feb., 248.
Fractures of os calcis (ab.), D. C. McKeever, April, 505.

CALCIFICATION
Angiomas, Calcification in (ab.), F. Y. Khoo, Jan., 128.
Calcifications in breast, Extensive (ab.), A. Kubat, March, 368.

CALCIFICATION—*Continued*
Calcifications within lungs, Significance of (ab.), D. A. Rhinehart, March, 380.
Calcified aortic stenosis, Isolated (ab.), W. F. Friedewald and A. R. Ewing, Feb., 259.
Calcified fecalith in appendix: report of case of acute suppurative appendicitis perforated by calcified fecalith (ab.), H. J. Shelley, April, 502.
Calcified scrotal tumor, A. Fine and S. Brown, Jan., 92.
Coracoclavicular ligament, Calcification of bursa of (ab.), H. J. McCurrich, April, 503.
Diagnosis of unusual calcareous shadows found on x-ray films of abdomen, C. B. Rose, May, 600.
Meniscus, Calcification of, and hypertrophic spurring (ab.), Roederer, Gaucher, and Jesover, April, 517.

CALCIUM, metabolism
Vitamin D in chronic arthritis, Massive doses of: effect on calcium metabolism (ab.), C. L. Steinberg, March, 366.

CALCULI
Biliary and urinary calculi, Differential diagnosis of (ab.), H. Pons, June, 751.
Calcareous shadows found on x-ray films of abdomen, Diagnosis of unusual, C. B. Rose, May, 600.
Calcium carbonate deposits in human gall bladder (ab.), A. T. Cameron, F. D. White, and S. Meltzer, April, 505.
Calculus of bladder in case previously treated for cancer of cervix (ab.), T. Nogier, March, 369.
Calculus of gall bladder with suppuration, Large (ab), E. Binet and Dillenseger, Feb., 251.
Common duct stones, Non-operative management of remaining (ab.), R. R. Best and N. F. Hicken, Feb., 251.
Gallstones, Formation of transparent gas-filled fissures in, and their significance for radiological diagnosis (ab.), Å. Åkerlund, June, 751.
Nephrolithiasis, Late results in conservative management of (ab.), J. T. Priestley and W. F. Braasch, March, 377.
Parotid duct, Radiography of, L. W. Paul, May, 609.
Sialography in non-neoplastic diseases of parotid gland, Application of, J. V. Blady and A. F. Hocker, Feb., 131 (135).
Ureteric calculus, Radiological aspect of treatment of (ab.), D. G. Maitland, March, 368.
Urinary calculus, Brief review of 426 consecutive cases of (ab.), H. P. Winsbury-White, Feb., 251.

CANCER
Biliary system, Primary carcinoma of: clinico-pathological analysis of 40 cases (ab.), R. D'Aunoy, M. A. Ogden, and B. Halpert, March, 369.
Bladder carcinoma, Radium therapy of: five-year results, failures, and future therapy (ab.), B. S. Barringer, May, 641.
Breast treated by teleroentgentherapy, Vertebral metastasis from carcinoma of (ab.), A. Poulain, Feb., 250.
Breast, Treatment of carcinoma of: technic, complications, and results, E. Newcomer, Feb., 161.
Breast, Value of radiation in treatment of carcinoma of, L. G. Allen, Jan., 63.
Bronchogenic carcinoma from pathologic and radiologic points of view, Primary (ab.), W. L. Mattick and E. M. Burke, Feb., 252.
Bronchogenic carcinoma: study of eight autopsied cases, W. E. Howes and S. G. Schenck, Jan., 8.
Bronchoscopy and esophagoscopy of importance in general practice, Phases of (ab.), V. J. Schwartz, Feb., 250.
Bronchus, Primary carcinoma of (ab.), I. H. Lockwood, June, 752.
Cancer campaign: suggestions for better treatment of malignant growths (ab.), A. M. Begg, Feb., 253.
Cancerology indispensable to practitioner, Practical ideas concerning (ab.), R. Reding, Feb., 253.
Cervix uteri, Carcinoma of, Treatment of (ab.), R. E. Myers, March, 369.
Cervix uteri, Factors relating to treatment of (ab.), G. H. Johnson, March, 390.
Collum carcinoma, Results obtained in radiation treatment of inoperable (ab.), I. de Büben, March, 370.
Colon, Carcinoma of, Large pedunculated lipoma of colon nine years after resection of, O. C. Julian, April, 479.
Colon disorders, Fundamentals in surgical treatment of (ab.), L. M. Larson, Feb., 254.
Colon of masked type, Cancer of transverse (ab.), A. Cade and M. Milhaud, March, 371.
Esophagus, Studies regarding technic and methods in radiation therapy of carcinoma of (ab.), A. Adam, Feb., 257.
Gastric cancer, Two cases of: difficulty of radio-diagnosis of lesions of pyloric antrum (ab.), P. Vasselle, March, 369.
Gastric cancer, X-ray diagnosis of (ab.), A. J. Delario, June, 752.
Histological tumor variants and their influence upon radiosensitivity, Some, I. A. B. Cathie, April, 425.
Hypopharynx, Results of radiation therapy in carcinoma of (ab.), E. Bandhauer, Feb., 252.
Intra-oral carcinoma, Cervical lymph nodes in: surgery or irradiation? (ab.), J. J. Duffy, March, 370.
Larynx and hypopharynx, Results of roentgen and radium therapy in carcinoma of (ab.), R. Müller, April, 503.
Larynx, Tumors of (ab.), F. A. Figi, May, 632.
Lip cancer at Radiological Clinic, Lund, Sweden, Review of 20 years' radium treatment of (ab.), A. Bergendal, Jan., 123.
Lung, Association of silicosis and carcinoma of (ab.), M. O. Klotz, May, 634.
Lung, Primary carcinoma of (ab.), M. O. Klotz, Feb., 252.
Lung, Primary carcinoma of: clinical study of 160 cases in five years (ab.), A. Arkin, March, 379.
Lung, Radiation therapy in primary neoplasms of (ab.), R. E. Myers, March, 379.
Lymphatics (ed.), April, 491.
Mastitis and breast cancer, Chronic: family history of five sisters (ab.), W. S. Hadley, Feb., 250.
Oto-rhino-laryngological cancer by radiations, Indications and results of treatment of (ab.), L. Eloy, Feb., 253.
Pancreas, Roentgen diagnosis of diseases of (ab.), R. Pohl, March, 381.
Parotid gland, Application of sialography in non-neoplastic diseases of, J. V. Blady and A. F. Hocker, Feb., 131.
Pharynx and larynx, Treatment of carcinoma in, and results (ab.), L. Colledge, March, 370.
Prevention and control of cancer: plan for nation-wide organization (ab.), J. W. Schereschewsky, Feb., 254.
Primary cancer of lung (ab.), D. S. King, April, 511.
Primary carcinoma of lung, Roentgenographic images in, L. A. Hochberg, June, 713.
Primary malignant lesions, Occurrence of two or more, J. J. Collins, April, 462.
Prostate, Metastases from occult carcinoma of (ab.), O. S. Culp, April, 513.
Pylorus, Pedunculated cancer of (ab.), Poirier and Lamoureaux, April, 520.
Radiology in elucidation of hemoptysis, Value of (ab.), F. G. Wood, March, 378.
Renal carcinoma: study of 95 cases with follow-up notes on 36 (ab.), T. R. Fetter, April, 509.
Roentgen therapy (ab.), L. S. McAlister, Feb., 253.
Roentgen therapy by method of Chaoul, E. P. Pendergrass, P. J. Hodes, and C. J. Garrahan, Feb., 142 (152).
"Romantic" attributes of "lawlessness" and "malignancy" in cancer (ab.), H. Oertel, June, 751.
Skin and lip, Early results of near distance radiation in carcinoma of (ab.), A. Hrabovszky, Feb., 254.
Skin and lip, Radium therapy of carcinoma of (ab.), J. Körbler, March, 383.
Skin malignancy, Treatment of, by irradiation (ab.), H. W. Jacox, March, 369.
Stomach, Early diagnosis of cancer of (ab.), L. J. Notkin, June, 752.
Stomach, Symptoms, diagnosis, and treatment of cancer of (ab.), J. S. Horsley, March, 385.
Thymus, Carcinoma of, with marked pulmonary osteo arthropathy, E. R. Miller, June, 651.
Tumors of upper pole of stomach (ab.) B. Stenström, Jan., 129.
Urinary prolans in cancer cases (ab.), E. Harvey, Feb., 252.
Uterine carcinoma, Development of treatment methods for, at Women's Clinic of University of Würzburg (ab.), T. C. Neeff, May, 649.
Uterine carcinoma, Present method of radiation therapy of, in first gynecological clinic of University of Munich (ab.), F. G. Dietel, May, 650.
Uterine cervix, Carcinoma of (ab.), H. H. Bowing and R. E. Fricke, May, 649.
[Uterus] Carcinoma of cervix, Radium therapy of (ab.), K. Wasserburger and H. Smereker, Jan., 122.
[Uterus] Cervix and breast, Carcinoma of: prognosis and preferable therapy (ab.), E. D. Grenberger, March, 370.
[Uterus] Cervix, Cancer of: therapeutic and biological thoughts (ab.), S. Laborde, April, 520.
[Uterus] Cervix carcinoma, Early results in, from single and divided doses of roentgen radiation (ab.), A. N. Arneson, March, 371.
Uterus, Is it possible to use radium bomb for intravaginal treatment of carcinoma of, and would it be possible to improve considerably distribution of radiation? (ab.), R. du Mesnil de Rochemont, April, 515.
[Uterus] Cervix, Results and experiences in treatment of carcinoma of, with special consideration of radium therapy (ab.), P. Caffier, May, 649.
[Uterus] Cervix, Results in treatment of carcinoma of, at Women's Clinic of University of Göttingen from 1926 to 1937 (ab.), F. Erichsen, April, 520.
[Uterus] Cervix, Treatment of carcinoma of, in Women's Clinic of University of Königsberg from 1910 to 1937 (ab.), F. v. Mikulicz-Radecki, March, 390.
Uterus, Multiple heteromorphologic malignant tumors of, H. W. Jacox, G. Major, and M. R. Baker, Jan., 51.
Uterus, radiation therapy of carcinoma of, Avoidance of injurious effects on bladder in (ab.), T. C. Neeff and F. Hoff, June, 749.
Uterus, Thirty years' experience in treatment of carcinoma of (ab.), A. Mayer, March, 390.
Venous thrombosis, Carcinoma and: frequency of association of carcinoma in body or tail of pancreas with multiple venous thrombosis (ab.), E. E. Sproul, June, 752.
Vertebral cancer, Remarks on (ab.), F.-G. Marill, R. Raynaud, and A. Huguenin, April, 517.
X-ray treatment of operable cancer of breast, Technic of, based upon analysis of Keynes' radium technic, J. R. Andrews, March, 294.

CARCINOMA. *See* **Cancer.**
CAROTID SINUS
Roentgen therapy in carotid sinus syndrome, Use of, C. A. Stevenson, Feb., 209.
CARTILAGE
Intervertebral cartilage as cause of back pain and sciatica, Displacement of (ab.), E. F. Fincher and E. B. Walker, March, 366.
Osseous-cartilaginous growth, Rare disturbances of (ab.), F. Holldack, March, 366.
CATARRH
Roentgen therapy by method of Chaoul, E. P. Pendergrass, P. J. Hodes, and C. J. Garrahan, Feb., 142 (150).
CECUM
Diverticulitis of cecum, Solitary (ab.), W. N. Graves, Feb., 258.
CELLS
Animal cells, Experimental study on effect of change of environments of, on their radiosensitivity (ab.), Y. Kagami, April, 501.
Radiosensitivity and cell division (ab.), W. Luther, Feb., 249.
Radiosensitivity and recurrent growth in *Obelia*, P. S. Henshaw, April, 466.
Roentgen therapy, Dosage and method of, for inflammatory conditions, A. U. Desjardins, June, 699.
CHAOUL METHOD
Roentgen therapy by method of Chaoul, E. P. Pendergrass, P. J. Hodes, and C. J. Garrahan, Feb., 142.
CHAUFFARD-STILL'S DISEASE. *See* **Arthritis deformans.**
CHEST
Shape of chest, Correlation of positive reaction to tuberculin and (ab.), S. A. Weisman, April, 519. *See* **Thorax.**
CHILDREN
Artificial pneumothorax in children (ab.), P. F. Fitzpatrick, April, 513.
Childhood tuberculosis, Certain significant aspects of (ab.), R. M. Tyson, Jan., 127.
Cystic hygroma of neck (ab.), B. L. Fleming, Jan., 129.
Deformities of hip joint in children (ab.), C. G. Teall, March, 374.
Intussusception in infancy and childhood (ab.), G. P. Grigsby and S. E. Kaplan, Jan., 117.
Lipoid pneumonia in infants and children, R. S. Bromer and I. J. Wolman, Jan., 1.
Pyelitis in girls, Late effects of acute (ab.), L. R. Wharton, L. A. Gray, and H. G. Guild, April, 507.
Radiographic visualization of "true joint fissure," Conditions responsible for (ab.), W. Magnusson, Feb., 260.
Retroperitoneal cyst with agenesia of kidney, K. Kornblum and J. A. Ritter, April, 416.
Urinary tract in children, Non-obstructive dilatations of upper (ab.), A. B. Hepler, April, 507.
Waldeyer's ring in children, Roentgen therapy of diseases of (ab.), H. Weissig, March, 387.
CHOLECYSTOGRAPHY
Calcium carbonate deposits in human gall bladder (ab.), A. T. Cameron, F. D. White, and S. Meltzer, April, 505.
Error of technic in administration of tetraiodide with intolerance and prolonged visibility of gall bladder (ab.), Nemours-Auguste, April, 505.
Intravenous cholecystography, Danger of (ab.), W. Lutz and H. Seyfried, April, 506.
Single-dose *versus* double-dose methods of administering dye: cholecystography, M. Feldman, Feb., 155.
COCCIDIOIDES
Coccidioides infection (coccidioidomycosis). II.—Primary type of infection (ab.), E. C. Dickson and M. A. Gifford, April, 509.
COLITIS
Right-sided (regional) colitis (ab.), B. B. Crohn and A. A. Berg, Jan., 117.
COLON
Cancer of transverse colon of masked type (ab.), A. Cade and M. Milhaud, March, 371.
Colospasms, Causes and results (ab.), L. Gleize-Rambal, Feb., 255.
Diverticulitis and diverticulosis of colon, Prognosis (ab.), P. W. Brown and D. M. Marcley, Feb., 254.
Insufflation of colon as method of diagnosis in gastrocolic fistula following post-operative jejunal peptic ulcer (ab.), L. Weigel, May, 637.
Invagination of colon, Case of genuine (ab.), B. S. Holmgren, Feb., 254.
Pedunculated lipoma of colon nine years after resection of carcinoma of colon, Large, O. C. Julian, April, 479.
Radiography after injection of pitressin, Several cases of: experimental proofs (ab.), P. C. Smyrniotis, Jan., 122.
Roentgen kymography of normal colon: defecation in man (ab.), R. A. Rendich and L. A. Harrington, March, 371.
Surgical treatment of colon disorders, Fundamentals in (ab.), L. M. Larson, Feb., 254.
CONDYLOMA, rectal
Roentgen therapy by method of Chaoul, E. P. Pendergrass, E. P. Hodes, and C. J. Garrahan, Feb., 142 (152).
CONTRAST MEDIA
Air injection of joints, Technic of (ab.), R. Meyer-Wildisen, Feb., 260.
Breast lesions by means of contrast media, Roentgen visualization and diagnosis of (ab.), N. F. Hicken, R. R. Best, H. B. Hunt, and T. T. Harris, March, 368.
Mammography by contrast media, Limitations and dangers of (ab.), S. A. Romano and E. M. McFetridge, April, 504.
Mammography, Studies in evaluation of (ab.), R. A. Reis and S. D. Mesirow, April, 504.
Pyelography, Acute iodism following intravenous (ab.), Lamarque, Guibal, and Bétoulières, April, 504.
CORACOID PROCESS. *See* **Scapula.**
CRANIUM
Base of skull, with particular reference to fractures (ab.), W. J. Mellinger, March, 372.
Cranial and spinal lesions in epileptic: difficulties of interpretation (ab.), R. Raynaud, A. Huguenin, and H. Tillier, April, 505.
Hyperostosis syndrome, Frontal (ab.), H. M. Salzer, April, 503.
Schüller-Christian's disease (ab.), M. Esser, May, 643.
Schüller-Christian's disease (ab.), M. Schieber, May, 643.
Tumors, Bony intracranial (ab.), C. Pilcher, May, 647.
Tumors, perisellar, X-ray aspect of (ab.), T. Blühbaum and M. Spritzer, May, 648.
CROUZON'S DISEASE. *See under* **Bones, diseases.**

DEGLUTITION, disorders
Dysphagia, Hysterical: report of case (ab.), H. W. Schmidt, Feb., 256.
DIGITALIS AND DIGITALIS PREPARATIONS
Digitalis on isolated heart, Action of (ab.), L. N. Katz, M. Mendlowitz, and H. A. Kaplan with assistance of K. Jochim and E. Lindner, April, 508.
DISCUSSIONS
Berck, Maurice, of "Further experience with roentgen therapy for bronchiectasis," June, 697.
Bloom, Arthur R., of "Osteogenesis imperfecta tarda," J. F. Lutz and L. C. Pusch, April, 402.
Friedman, Milton, of "Recovery following human ovarian irradiation," H. W. Jacox, May, 542.
Levene, George, of "Pulmonary artery; roentgenographic and roentgen kymographic study," S. Brown, J. E. McCarthy, and A. Fine, Feb., 188.
Menville, Leon J., of "Value of roentgen examination of paranasal sinus," V. C. Johnson, March, 309.
Moore, Paul D., of Symposium on Radiotherapy for Inflammatory Conditions, June, 706.
Moore, Sherwood, of "Some experiences, experimental and clinical, with direct irradiation of neurological tumors during operation with low voltage radiation," J. R. Carty and B. S. Ray, March, 330.
Newell, R. R., of "Treatment of acute and chronic inflammatory conditions by fractional doses of x-ray," H. A. Osgood, March, 314.
Idem, of "Density of central shadow in diagnosis of intrathoracic lesions," L. G. Rigler, March, 323.
Peirce, Carleton B., of "Bone changes in primary hypogonadism," L. M. Hurxthal and H. F. Hare, May, 527.
Perry, Gentz, of "Recovery following human ovarian irradiation," H. W. Jacox, May, 544.
Rhinehart, Barton A., of "Roentgenologic consideration of gastritis," M. Feldman, June, 731.
Schmitz, H., of "Recovery following human ovarian irradiation," H. W. Jacox, May, 543.
Smith, Lester A., of "Osteogenesis imperfecta tarda," L. F. Lutz and L. C. Pusch, April, 402.
Teperson, Hyman I., of "Recovery following human ovarian irradiation," H. W. Jacox, May, 543.
Ude, Walter H., of "Density of central shadow in diagnosis of intrathoracic lesions," L. G. Rigler, March, 322.
DIVERTICULITIS
Colon, Prognosis of diverticulitis and diverticulosis of (ab.), P. W. Brown and D. M. Marcley, Feb., 254.
DOSAGE
Assessing and prescribing dosage in radiation therapy in simple terms, Value of, R. Paterson, Feb., 221.
Back-scatter, Study of (ab.), E. H. Quimby, L. D. Marinelli, and J. H. Farrow, March, 371.
Breast, Treatment of carcinoma of: technic, complications, and results, E. Newcomer, Feb., 161.
Clinical dosage meters using thimble ionization chamber, Note on use of, M. C. Reinhard, March, 282.
Co-relation of physical and clinical data in radiation therapy, W. H. Meyer, Jan., 23.
Dosage units and ionization method (ab.), R. M. Sievert, March, 372.
Dose in near-distance x-ray tubes and body cavity tubes of various constructions, Distribution of (ab.), T. Zimmer, June, 747.
Dosimetric and radiobiologic experiments with fast neutrons. —I. (ab.), K. G. Zimmer, April, 504.
Dosimetric and radiobiologic experiments with fast neutrons.—II. (ab.), K. G. Zimmer and N. W. Timoféeff-Rassovsky, April, 504.
Efficiency curves in quantitative radiobiology, W. H. Love, June, 708.
Inoperable collum carcinoma, Results obtained in radiation treatment of (ab.), I. de Büben, March, 370.
Irradiation, Recovery following human ovarian, H. W. Jacox, May, 538.
Language of engineers and radiologists: new x-ray terms proposed: rhegma, rhothion, kludon, plem, aith, R. R. Newell, March, 270 (272).

DOSAGE—*Continued*
Low voltage radiation, Some experiences, experimental and clinical, with direct irradiation of neurological tumors during operation with, J. R. Carty and B. S. Ray, March, 325.
Measurements by simple computations, Dosage, H. M. Parker, May, 591.
Potential in deep therapy, Problem of (ab.), L. Graf and J. Graf, Jan., 122.
Primary and secondary beta rays in radium therapy, Significance of (ab.), W. Minder, March, 383.
Radiation quality factors and depth, Relation between, A. Mutscheller, Jan., 87.
Radio-active emanation, Therapy with (ab.), H. Hirschi and H. Bodmer, April, 515.
Radiobiological experiments with pupæ of *Drosophila* (ab.), A. Liechti, W. Minder, and J. H. Müller, April, 502.
Roentgen and radium therapy in carcinoma of larynx and hypopharynx, Results of (ab.), R. Müller, April, 503.
Roentgen caustic (ab.), G. J. van der Plaats, March, 371.
Roentgen radiation from tube actuated by Van de Graaf generator, Physical measurements on, J. C. Hudson, May, 530.
Roentgen therapy by method of Chaoul, E. P. Pendergrass, P. J. Hodes, and C. J. Garrahan, Feb., 142.
Roentgen therapy, Dosage and method of, for inflammatory conditions, A. U. Desjardins, June, 699.
Roentgen treatment of leukemia, with report of pregnancy in case of lymphatic leukemia, E. K. Harrison and R. J. Reeves, March, 284.
"Rotation" irradiation, Determination of dose in (ab.), R. du Mesnil de Rochemont, March, 372.
Tissue dosage in radiation therapy, Measurement of, E. H. Quimby, May, 583.
Tolerance dose of radium, Researches in problem of radium poisoning and, B. Rajewsky, Jan., 57.
Ultra-violet rays on body weight, Influence of, F. Ellinger, Feb., 157.
X-ray treatment of operable cancer of breast, Technic of, based upon analysis of Keynes' radium technic, J. R. Andrews, March, 294.

DEFECATION
Normal colon, Roentgen kymography of: defecation in man (ab.), R. A. Rendich and L. A. Harrington, March, 371.

DUODENUM
Anomaly, Duodenal (ab.), H. Tillier, Feb., 258.
Characteristic duodenal deformity in cases of different kinds of peri-vaterial enlargement of pancreas (ab.), N. Frostberg, March, 381.
Diverticula of digestive tract, Multiple (ab.), G. Ronneaux and Witasse, April, 506.
Diverticulum of duodenum (ab.), D. Wheeler, Feb., 255.
Hemorrhage, Problem of gastro-duodenal (ab.), A. M. Snell, May, 636.
Invagination of pylorus into duodenum, Unusual case of (ab.), L. Galifi, Feb., 255.
"Ulcer, large duodenal," Radiologic characteristics of so-called (ab.), D. S. Bartstra, May, 636.

DUST
Radiographic studies of excretion of dusts from lungs (ab.), A. E. Barclay, K. J. Franklin, and R. G. Macbeth, May, 635.

DYES
Cholecystography: single-dose *versus* double-dose methods of administering dye, M. Feldman, Feb., 155.

DYSPEPSIA
Chronic dyspepsia at various ages: analysis of 4,223 cases, Incidence and causes of (ab.), A. B. Rivers and A. E. M. Ferreira, Feb., 256.

EAR
Otitis media, acute, Evaluation of roentgen irradiation as adjunct in treatment of: preliminary report, A. H. Dowdy, C. A. Heatly, and W. W. Pierce, June, 661.
Mastoiditis, Acute, (ab.), J. G. Parsons, May, 635.
Petrous tip suppuration: report of three cases, Some observations on (ab.), D. E. S. Wishart, Feb., 256.
Septic patient with otitis media, Management of (ab.), J. H. Maxwell, Jan., 120.

ECHINOCOCCOSIS
Echinococcus of spine, Case of, difficult to interpret roentgenologically (ab.), C. Guidotti, May, 645.

EMBOLISM, pulmonary
Roentgen diagnosis of lung embolism (ab.), N. Westermark, May, 634.

EMBRYOLOGY
Retroperitoneal cyst with agenesia of kidney, K. Kornblum and J. A. Ritter, April, 416.

EMPHYSEMA
Spontaneous mediastinal emphysema, with report of case associated with spontaneous pneumothorax, J. B. Morey and M. C. Sosman, Jan., 19.

EMPYEMA
Typhoid empyema: report of case operated upon and cured (ab.), A. C. Neto and J. Finocchiaro, Jan., 119.

ENDOCRINE GLANDS
Hypogonadism, Bone changes in primary, L. M. Hurxthal and H. F. Hare, May, 521.
Radiation therapy and glands of internal secretion (ed.), March, 360.

ENEMAS, barium
Barium enemas, Necessity of systematic use of, to disclose latent intestinal tuberculosis in cases with pulmonary tuberculosis (ab.), M. Picard, Jan., 128.

ENGLAND
Socialized medicine, Economic status of radiologist under: report on England, S. W. Donaldson, April, 486.

ENVIRONMENT
Change of environments of animal cells on their radiosensitivity, Experimental study on effect of (ab.), Y. Kagami, April, 501.

EPILATION
Roentgen epilation, E. Aronstein, Jan., 95.

EPILEPSY
Cranial and spinal lesions in epileptic: difficulties of interpretation (ab.), R. Raynaud, A. Huguenin, and H. Tillier, April, 505.
Epilepsy, Experience with roentgen therapy in (ab.), M. Sgalitzer, April, 505.
Epilepsy, Roentgen therapy of (ab.), W. von Weiser, April, 505.

ERYSIPELAS
Ultra-violet energy, Treatment of erysipelas with, M. E. Knapp, Feb., 195.

ESOPHAGOSCOPY
Hiatal hernia (ab.), H. J. Moersch, March, 374.

ESOPHAGUS
Carcinoma of esophagus, Studies regarding technic and methods in radiation therapy of (ab.), A. Adam, Feb., 257.
Dysphagia, Hysterical: report of case (ab.), H. W. Schmidt, Feb., 256.
Esophagopleural fistula: report of case, J. R. Phillips, Jan., 91.
Esophagoscopy of importance in general practice, Phases of bronchoscopy and (ab.), V. J. Schwartz, Feb., 250.
Hernia, Esophageal hiatus, with special reference to x-ray diagnosis (ab.), D. Eisen, Feb., 257.
Mega-esophagus and narrowing of terminal portion of esophagus (ab.), C. Bocca, Feb., 257.
Overflow, Lung abscess due to esophageal (ab.), D. A. Sampson, May, 634.
Peptic ulcer of esophagus (ab.), F. Norgaard, May, 636.
Peptic ulcer of esophagus (ab.), J. Terracol, P. Lamarque, and P. Bétoulières, Jan., 121.
Rupture of esophagus from blow on abdomen, C. A. Aldrich and W. E. Anspach, Jan., 93.

FAT TISSUE
Adipose tissue, Roentgen diagnostic importance of, J. Silbermann, Jan., 77.

FEMUR
Fractures of neck of femur, Two-plane direction and range finder for nailing (ab.), G. C. Engel and H. May, Feb., 258.
Giant-cell tumor ("osteoclastoma") of femur treated with x-rays (ab.), S. Dechambre, E. Dechambre, and J. Nebout, May, 648.

FETUS
Diagnosis of pregnancy, Plea for more frequent use of lateral roentgenogram in, M. J. Hubeny and P. J. Delano, May, 546.
Fetalometry, Roentgenographic pelvimetry and: elimination of errors due to movements between x-ray exposures, W. W. Fray and W. T. Pommerenke, March, 261.

FEVER THERAPY
Fever therapy in gonococcal infections, W. Bierman and C. L. Levenson, April, 454.

FIBROMA. *See* **Tumors, fibroma.**

FISTULA
Esophagopleural fistula, with report of case, J. R. Phillips, Jan., 91.
Gastrocolic fistula, W. Bailey and W. V. Knoll, March, 347.
Persistent fecal fistula after appendectomy, Lipiodol in treatment of (ab.), S. N. Mendelsohn and L. H. Schriver, April, 501.
parotid
Sialography in non-neoplastic diseases of parotid gland, Application of, J. V. Blady and A. F. Hocker, Feb., 131 (138).

FLUOROSCOPY
Myocardial damage, Concurrence of radiologic signs and electrocardiographic changes in (ab.), F. Barth, May, 631.
Responsibility of radiologist in training of hospital intern in fluoroscopy (ed.), R. Golden, Feb., 235.

FOOT
Normal first metatarso-phalangeal joint due to changes in direction of central ray, Variations in x-ray appearance of (ab.), B. S. Holmgren, April, 505.
Os calcis, Fractures of (ab.), D. C. McKeever, April, 505.

FORAMEN, intervertebral
Pathologic conditions of spine: painful disturbances of intervertebral foramina (ab.), L. A. Hadley, Jan., 124.

FOREIGN BODIES
Bronchoscopy and esophagoscopy of importance in general practice, Phases of (ab.), V. J. Schwartz, Feb., 250.
Common duct stones, Non-operative management of remaining (ab.), R. R. Best and N. F. Hicken, Feb., 251.

Planigraphy—application to thoracic diagnosis, W. E. Howes, May, 556 (558).

FRACTURES
Atlas, Fracture of, in automobile accidents: value of x-ray views for diagnosis (ab.), H. F. Plaut, March, 372.
Base of skull, with particular reference to fractures (ab.), W. J. Mellinger, March, 372.
Cervical spine, Three cases of injury to, including one of unrecognized fracture of odontoid (ab.), Brillouet and A. Viel, March, 372.
Femur, Two-plane direction and range finder for nailing fractures of neck of (ab.), G. C. Engel and H. May, Feb., 258.
Head injury, Unusual (ab.), C. K. Fuller, March, 385.
Healing of fractures, Some experimental studies of action of short waves on process of (ab.), E. Fischel, Feb., 258.
Noses, One hundred broken (ab.), J. W. Gerrie, March, 380.
Os calcis, Fractures of (ab.), D. C. McKeever, April, 505.
Pathologic fractures (ab.), R. K. Ghormley, C. G. Sutherland, and G. A. Pollock, Feb., 258.
Reduction of fractures under roentgenoscopic control: two instructive examples (ab.), H. Tillier, March, 372.
Scapula, Fracture of neck of (ab.), M. R. Charlton, Feb., 258.
Spontaneous rib fracture among tuberculous, Radiological study of (ab.), C. Sabbione, Jan., 127.

FUNGI
Coccidioides infection (coccidioidomycosis). II.—Primary type of infection (ab.), E. C. Dickson and M. A. Gifford, April, 509.
Lungs in agricultural workers, Occupational diseases of (ab.), R. Fawcitt, April, 512.

GALL BLADDER
Calcium carbonate deposits in human gall bladder (ab.), A. T. Cameron, F. D. White, and S. Meltzer, April, 505.
Calculus of gall bladder with suppuration, Large (ab.), E. Binet and Dillenseger, Feb., 251.
Cholecystography, Danger of intravenous (ab.), W. Lutz and H. Seyfried, April, 506.
Cholecystography: single-dose *versus* double-dose methods of administering dye, M. Feldman, Feb., 155.
Common duct stones, Non-operative management of remaining (ab.), R. R. Best and N. F. Hicken, Feb., 251.
Error of technic in administration of tetraiodide with intolerance and prolonged visibility of gall bladder (ab.), Nemours-Auguste, April, 505.
Gallstones, Formation of transparent gas-filled fissures in, and their significance for radiological diagnosis (ab.), Å. Åkerlund, June, 751.

GAS GANGRENE
Gas gangrene infections, Treatment of (ab.), J. J. Faust, April, 506.
Gas gangrene, Radiological aspects of early and advanced (ab.), A. Grlli, April, 506.

GASTRITIS. *See* **Stomach, inflammation.**

GASTRO-INTESTINAL TRACT
Cancer of stomach, Early diagnosis of (ab.), L. J. Notkin, June, 752.
Cardiospasm: report of case, M. Golob, April, 481.
Colon disorders, Fundamentals in surgical treatment of (ab.), L. M. Larson, Feb., 254.
Colospasms, Causes and results (ab.), L. Gleize-Rambal, Feb., 255.
Diverticula of digestive tract, Multiple (ab.), G. Ronneaux and Witasse, April, 506.
Diverticulitis of cecum, Solitary (ab.), W. N. Graves, Feb., 258.
Diverticulum of duodeno-jejunal angle (ab.), G. Dumont, April, 506.
Duodenal anomaly (ab.), H. Tillier, Feb., 258.
Duodenum, Diverticulum of (ab.), D. Wheeler, Feb., 255.
Dyspepsia at various ages: analysis of 4,223 cases, Incidence and causes of chronic (ab.), A. B. Rivers and A. E. M. Ferreira, Feb., 256.
Esophagus, Peptic ulcer of (ab.), F. Norgaard, May, 636.
Gastric lesion produced by posterior pituitary extract (ab.), M. H. Metz, Jan., 125.
Gastrocolic fistula, W. Bailey and W. V. Knoll, March, 347.
Gastroscopic studies (ab.), E. H. Gaither and J. L. Borland, Jan., 126.
Hemorrhage, Problem of gastroduodenal (ab.), A. M. Snell, May, 636.
Hernia, Esophageal hiatus, with special reference to x-ray diagnosis (ab.), D. Eisen, Feb., 257.
Invagination of pylorus into duodenum, Unusual case of (ab.), L. Galifi, Feb., 255.
Multiple ulcers of stomach and duodenum (ab.), P. Savy, M. Girard, and Z. Khayat, Jan., 121.
Myosarcoma of stomach: report of two cases, L. G. Allen and P. E. Hiebert, May, 567.
Peptic ulcer of esophagus (ab.), J. Terracol, P. Lamarque, and P. Bétoulières, Jan., 121.
Peptic ulcer treated by posterior pituitary extract (ab.), M. H. Metz and R. W. Lackey, Jan., 120.
Radiology of gastro-intestinal tract: value of co-operation (ab.), S. J. Borland, April, 506.
Roentgenologic consideration of gastritis, M. Feldman, June, 726.
Stomach, Influence of pituitrin on evacuation of (ab.), R. I. Levina, Jan., 126.
Stomach, Volvulus of (ab.), P. Chêne and M. Ramadout, Jan., 125.
Syphilis, Gastric, pseudo-neoplastic type: clinical and radiologic study (ab.), H. Marc and Sire, May, 645.
Syphilis, gastric, Two cases of (ab.), P. A. Blinkenberg, May, 645.
Tuberculosis of intestines in tuberculous anthracosilicosis (ab.), R. Charr and A. C. Cohen, Jan., 126.
Tumors of upper pole of stomach (ab.), B. Stenström, Jan., 129.
"Ulcer, large duodenal," Radiologic characteristics of so-called (ab.), D. S. Bartstra, May, 636.
Ulcer of stomach, Double: radiographs and specimen (ab.), V. Paschetta, May, 636.

GEIGER-MÜLLER COUNTER
Geiger-Müller counter: recent instrument in medicine and medical research (ab.), M. L. Weinstein and L. Rovner, April, 501.
Mitogenetic radiation, Present status of, A. Hollaender, April, 404 (408).

GENITO-URINARY TRACT
Bladder, Avoidance of injurious effects on, in radiation therapy of carcinoma of uterus (ab.), T. C. Neeff and F. Hoff, June, 749.
Bladder tumors, Radiological diagnosis of (ab.), W. Sitkowski, June, 749.
Calculi, Differential diagnosis of biliary and urinary (ab.), H. Pons, June, 751.
Chorionepithelioma in male (ab.), E. J. Knoflicek, March, 388.
Chorionepithelioma testis, with record of case, Observations of (ab.), S. McDonald, Jr., March, 388.
Cystadenoma in double kidney, Malignant papillary (ab.), N. F. Ockerblad and H. E. Carlson, April, 510.
Dermoid cyst of bladder (ab.), A. Lidzki, June, 749.
Diagnostic problems in surgical kidney disease (ab.), M. Muschat, April, 510.
Dilatation of lower thirds of left ureters, Two cases of cystic (ab.), E. Herskowits, April, 507.
Dilatations of upper urinary tract in children, Non-obstructive (ab.), A. B. Hepler, April, 507.
Embryoma of kidney (Wilms' tumor), ab., W. E. Ladd, April, 510.
Gonococcal infections, Fever therapy in, W. Bierman and C. L. Levenson, April, 454.
Heminephrectomy in disease of double kidney (ab.), E. Beer and W. H. Mencher, April, 509.
Pyelitis in girls, Late effects of acute (ab.), L. R. Wharton, L. A. Gray, and H. G. Guild, April, 507.
Renal carcinoma: study of 95 cases with follow-up notes on 36 (ab.), T. R. Fetter, April, 509.
Retroperitoneal cyst with agenesia of kidney, K. Kornblum and J. A. Ritter, April, 416.
Tumors, Renal (ab.), J. C. McClelland and J. R. F. Mills, March, 389.
Ureteric calculus, Radiological aspect of treatment of (ab.), D. G. Maitland, March, 368.
Urinary prolans in cancer cases (ab.), E. Harvey, Feb., 252.
Urology, Low back pain in relation to (ab.), S. F. Wildman, June, 748.

GERMANY
Economic status of radiologist under socialized medicine: report on Germany, S. W. Donaldson, March, 351.

GLOSSITIS. *See* **Tongue, inflammation.**

GOITER
Hyperthyroidism, Treatment of, with consideration of other of ductless glands as trigger mechanism: based upon observation of 360 cases, I. W. Jenkins, March, 340 (341).
Osteoporosis in hyperthyroidism (ab.), E. C. Bartels and G. E. Haggart, Feb., 249.
Removal of intrathoracic non-toxic nodular goiter, Relief of anginoid pain following (ab.), J. Edeiken and E. Rose, Feb., 259.

exophthalmic
Tracheal stenosis from roentgen therapy (ab.), L. H. Clerf and F. J. Putney, April, 514.

GONADS
Hypogonadism, Bone changes in primary, L. M. Hurxthal and H. F. Hare, May, 521.

GONOCOCCI, infections
Fever therapy in gonococcal infections, W. Bierman and C. L. Levenson, April, 454.

GRANULOMA, malignant. *See* **Lymphogranuloma.**

GYNECOLOGY AND OBSTETRICS
Gynecology, Radiation therapy in (ab.), S. Mitra, March, 384.
Hemorrhagic metritis cured by roentgen irradiation of hypophysis, Case of (ab.), J. Moro and Monmignaut, April, 507.
Metrorrhagia cured by radiotherapy: subsequent pregnancy (ab.), Dano and Lainé, April, 507.
Obstetrics, Practical employment of radiographic diagnosis in (ab.), P. Brault and A. Tizon, April, 508.
Radium therapy, Development of gynecological, especially

GYNECOLOGY AND OBSTETRICS—*Continued*
in treatment of non-malignant disease (ab.), C. J. Gauss, May, 642.
Uterine hemorrhage, Radiotherapy in non-malignant (ab.), B. Windeyer, May, 631.
HAIR, removal
Roentgen epilation, E. Aronstein, Jan., 95.
HAND
Melanosarcoma, Three-year cure of case of (ab.), Drevon and Mourgues, March, 389.
HEART and VASCULAR SYSTEM
Aneurysm of aorta, Dissecting: clinical recognition (ab.), A. J. Patek, April, 509.
Aneurysm of heart wall, Instructive case of, with "teeter-movement" symptom (ab.), L. Bischoff, June, 746.
Aneurysms of internal carotid artery in cavernous sinus, Saccular (ab.), G. Jefferson, April, 508.
Aortic stenosis, Isolated calcified (ab.), W. F. Friedewald and A. R. Ewing, Feb., 259.
Asbestosis (disc. of G. Levene), Feb., 189.
Carotid sinus syndrome, Use of roentgen therapy in, C. A. Stevenson, Feb., 209.
Circulation in pericardial effusion, Studies of (ab.), H. J. Stewart, N. F. Crane, and J. E. Deitrick, March, 373.
Digitalis on isolated heart, Action of (ab.), L. N. Katz, M. Mendlowitz, and H. A. Kaplan with assistance of K. Jochim and E. Lindner, April, 508.
Enlargement, Diagnosis of cardiac (ab.), W. Frey, April, 509.
Essential hypertension, Effects of pentothal sodium on electrocardiogram on patients with (ab.), C. J. Betlach, Jan., 128.
Goiter, Relief of anginoid pain following removal of intrathoracic non-toxic nodular (ab.), J. Edeiken and E. Rose, Feb., 259.
Heart at puberty, Size, variability, and correlation of (ab.), G. Marzocchi, Feb., 259.
Heart, Radiological examination of (ab.), L. E. Rothstadt, March, 373.
Intrathoracic lesions, Density of central shadow in diagnosis of, L. G. Rigler, March, 316.
Left auricular dilatation in auricular fibrillation, Significance of (ab.), M. L. Sussman and M. T. Woodruff, March, 373.
Pulmonary artery: roentgenographic and roentgen kymographic study, S. Brown, J. E. McCarthy, and A. Fine, Feb., 175.
Radiography of heart, Cross-sectional, G. Danelius, Feb., 190.
Radiologic signs and electrocardiographic changes in myocardial damage, Concurrence of (ab.), F. Barth, May, 631.
Radiology in elucidation of hemoptysis, Value of (ab.), F. G. Wood, March, 378.
Sarcoma in peri-myocardium, Primary (ab.), P. Cossio and I. Berconsky, May, 631.
Systolic expansion of heart's ventricles (ab.), A. C. Morelli, April, 508.
HEART, blood supply
X-ray inquiry into genesis of current of venous blood and lymph, K. Mayer, March, 275.
HEMANGIOMA. *See* **Tumors, angioma.**
HEMATEMESIS
Stomach, Hematemesis and diaphragmatic hernia of (ab.), P. Carnot and A. Lafitte, March, 386.
HEMOCLASTIC CRISIS
Leukopenia, Therapy of x-ray (ab.), C. Carrić, April, 515.
HEMOPHILIA
Joint changes in hemophilia, N. B. Newcomer, May, 573.
HEMOPTYSIS
Radiology in elucidation of hemoptysis, Value of (ab.), F. G. Wood, March, 378.
HEMORRHAGE
Gastroduodenal hemorrhage, Problem of (ab.), A. M. Snell, May, 636.
Hemorrhagic disorders, Roentgen treatment of certain (ab.), L. H. Garland, March, 385.
Radium therapy, Intra-uterine, of hemorrhagic metropathies (ab.), A. Pickhan, May, 641.
Uterine hemorrhage, Radiotherapy in non-malignant (ab.), B. Windeyer, May, 631.
HEMORRHOIDS
Hemorrhoids and ano-rectal angiomas in infants (ab.), A. Bensaude and F. Bertillon, Jan., 123.
HERNIA, diaphragmatic
Diaphragmatic hernia (ab.), E. M. Jones, March, 373.
Stomach, Hematemesis and diaphragmatic hernia of (ab.), P. Carnot and A. Lafitte, March, 386.
esophageal hiatus
Esophageal hiatus hernia, with special reference to x-ray diagnosis (ab.), D. Eisen, Feb., 257.
hiatal
Hiatal hernia (ab.), H. J. Moersch, March, 374.
HIP JOINT
Acute arthritis developing in hip joint presenting lesions of post-traumatic coxarthritis (ab.), Lamarque and Bétoulières, March, 374.
Hip joint in children, Deformities of (ab.), C. G. Teall, March, 374.
Sarcoma, Voluminous osteogenic, of left coxofemoral region (ab.), Carteret, Dillenseger, and P. Bertrand, May, 643.
Traumatic dislocation of hip followed by Perthes' disease (ab.), R. R. Goldenberg, March, 375.
HISTOLOGY
Histological tumor variants and their influence upon radiosensitivity, Some, I. A. B. Cathie, April, 425.
Historadiography (ab.), P. Lamarque, April, 501.
HODGKIN'S DISEASE. *See* **Lymphogranuloma.**
HORMONES
Menstrual dysfunctions and sterility, Roentgen treatment of: analysis of 108 cases, S. Bruck and J. M. Fruchter, April, 446.
HOSPITALS
Radiological department in general hospital, Discussion on planning and organization of (ab.), R. S. Paterson, J. S. Fulton, and R. J. Sankey, May, 639–641.
X-ray rentals in hospitals: analysis of current rental costs in hospitals and medical buildings, L. H. Garland, Jan., 46.
HYGROMA. *See* **Bursa.**
HYPERTENSION. *See* **Blood pressure, high.**
HYPOPHYSIS CEREBRI. *See* **Pituitary Body.**

INFANTS
Birth weight and size of thymus shadow in 2,000 new-born, Study of relations between (ab.), S. W. Donaldson, Jan., 126.
Erysipelas with ultra-violet energy, Treatment of, M. E. Knapp, Feb., 195 (196).
Hemorrhoids and ano-rectal angiomas in infants (ab.), A. Bensaude and F. Bertillon, Jan., 123.
Intussusception in infancy and childhood (ab.), G. P. Grigsby and S. E. Kaplan, Jan., 117.
Lipoid pneumonia in infants and children, R. S. Bromer and I. J. Wolman, Jan., 1.
Radiography of infants' chests, Table for use in, H. Geissberger, Jan., 96.
INFECTION
Acute and chronic inflammatory conditions, Treatment of, by fractional doses of x-ray, H. A. Osgood, March, 311.
Amebic infections of large bowel, Further consideration of roentgen-ray manifestations in, J. C. Bell, March, 332.
Arthritis, New surgical procedure in acute infectious (ab.), H. E. Hipps, Feb., 248.
Coccidioides infection (coccidioidomycosis). II.—Primary type of infection (ab.), E. C. Dickson and M. A. Gifford, April, 509.
Diseases of lungs in agricultural workers, Occupational (ab.), R. Fawcitt, April, 512.
Focal (dental) infection, Diagnosis of, especially by means of roentgenogram (ab.), W. Praeger, Feb., 255.
Fungus infections, Radiation therapy of (ab.), D. Spangler, March, 375.
Gas gangrene infections, Treatment of (ab.), J. J. Faust, April, 506.
Gas gangrene, Radiological aspects of early and advanced (ab.), A. Grlli, April, 506.
Gonococcal infections, Fever therapy in, W. Bierman and C. L. Levenson, April, 454.
Infection, Radiation therapy of (ab.), H. G. Reineke, March, 376.
Liver abscess, Pyogenic (ab.), E. L. Eliason, R. B. Brown, and D. P. Anderson, April, 511.
Mastoiditis, Acute (ab.), J. G. Parsons, May, 635.
Otitis media, acute, Evaluation of roentgen irradiation as adjunct in treatment of: preliminary report, A. H. Dowdy, C. A. Heatly, and W. W. Pierce, June, 661.
Peritonitis, acute, and other infections, Roentgen treatment of, with mobile x-ray apparatus, J. F. Kelly and D. A. Dowell, June, 675.
Petrous tip suppuration: report of three cases, Some observations on (ab.), D. E. S. Wishart, Feb., 256.
Pneumonias, Chronic (ab.), J. G. Scadding, May, 637.
Pulmonary suppuration, Non-putrid (ab.), M. L. Sussman, May, 633.
Pyelitis in girls, Late effects of acute (ab.), L. R. Wharton, L. A. Gray, and H. G. Guild, April, 507.
Roentgen therapy by method of Chaoul, E. P. Pendergrass, P. J. Hodes, and C. J. Garrahan, Feb., 142 (152).
Sinus infections, Roentgen therapy of carefully selected, F. M. Hodges and L. O. Snead, June, 669.
Tonsillitis, Roentgen therapy of chronic (ab.), P. Heb, March, 386.
INFLAMMATION
Acute and chronic inflammatory conditions, Treatment of, by fractional doses of x-ray, H. A. Osgood, March, 311.
Arthritis, New surgical procedure in acute infectious (ab.), H. E. Hipps, Feb., 248.
Bronchial stenosis, Rôle of inflammatory, in etiology of bronchiectasis (ab.), P. H. Holinger, June, 749.
Chauffard-Still's disease, Treatment of (ab.), F. LePennetier, March, 385.
Erysipelas with ultra-violet energy, Treatment of, M. E. Knapp., Feb., 195.
Gastritis, Roentgenologic consideration of, M. Feldman, June, 726.
Glossitis, Median rhomboid, J. F. Sammet, Feb., 215.
Metritis cured by roentgen irradiation of hypophysis, Case of hemorrhagic (ab.), J. Moro and Monmignaut, April, 507.
Otitis media, acute, Evaluation of roentgen irradiation as adjunct in treatment of: preliminary report, A. H. Dowdy, C. A. Heatly, and W. W. Pierce, June, 661.
Peritonitis, acute, and other infections, Roentgen treatment

of, with mobile x-ray apparatus, J. F. Kelly and D. A. Dowell, June, 675.
Radiation therapy in acute and chronic inflammatory conditions (ab.), H. J. Ullmann, May, 631.
Roentgen therapy for inflammatory conditions, Dosage and method, A. U. Desjardins, June, 699.
Roentgen therapy of inflammatory conditions, Fundamental principles of (ab.), W. von Weiser, Feb., 259.
Roentgen treatment of inflammatory diseases (ab.), G. Clement, May, 632.
Sialography in non-neoplastic diseases of parotid gland, Application of, J. V. Blady and A. F. Hocker, Feb., 131 (133).

INTESTINES
Calcified fecalith in appendix: report of case of acute suppurative appendicitis perforated by calcified fecalith (ab.), H. J. Shelley, April, 502.
Chronic intestinal amebiasis, Diagnosis of (ab.), M. Poirot, March, 376.
Colitis, Right-sided (regional), ab., B. B. Crohn and A. A. Berg, Jan., 117.
Colon disorders, Fundamentals in surgical treatment of (ab.), L. M. Larson, Feb., 254.
Colon, Insufflation of, as method of diagnosis in gastrocolic fistula following post-operative jejunal peptic ulcer (ab.), L. Weigel, May, 637.
Diverticulitis and diverticulosis of colon, Prognosis of (ab.), P. W. Brown and D. M. Marcley, Feb., 254.
Enteritis, Regional (ab.), J. V. Prouty, March, 376.
Intestinal obstruction (ab.), F. Christopher, Jan., 117.
Intestinal obstruction, Acute (ab.), B. H. Nichols, Jan., 118.
Intussusception in infancy and childhood (ab.), G. P. Grigsby and S. E. Kaplan, Jan., 117.
Invagination of colon, Case of genuine (ab.), B. S. Holmgren, Feb., 254.
Large bowel, Further consideration of roentgen-ray manifestations in amebic infections of, J. C. Bell, March, 332.
Primary tumors of duodenum and jejunum and lymphogranuloma of duodenum (ab.), M. Cace, April, 519.
Right quadrant, Problems presented by lesions of (ab.), O. C. Pickhardt and H. A. Rafsky, March, 376.
Stenoses and false stenoses of intestine in course of grave anemias, J.-C. Roux and J. Mialaret (ab.), Jan., 117.
Tuberculosis of intestines in tuberculous anthracosilicosis (ab.), R. Charr and A. C. Cohen, Jan., 126.
Volvulus of sigmoid megacolon, Roentgenological diagnosis of, with report of two cases, M. R. Hall (ab.), Jan., 117.

tuberculosis
Barium enemas to disclose latent intestinal tuberculosis in cases with pulmonary tuberculosis, Necessity of systematic use of (ab.), M. Picard, Jan., 128.

INTUSSUSCEPTION
Intussusception in infancy and childhood (ab.), G. P. Grigsby and S. E. Kaplan, Jan., 117.
Invagination of colon, Case of genuine (ab.), B. S. Holmgren, Feb., 254.
Invagination of pylorus into duodenum, Unusual case of (ab.), L. Galifi, Feb., 255.

IODINE and IODINE COMPOUNDS
Acute iodism following intravenous pyelography (ab.), Lamarque, Guibal, and Bétoulières, April, 504.
Tetraiodide, Error of technic in administration of, with intolerance and prolonged visibility of gall bladder (ab.), Nemours-Auguste, April, 505.

JAW
Cystic enlargement of mandible in Senegalese, Diffuse (ab.), Castay, April, 502.
Lower jaw of Senegalese, Puffy and cystic appearance of (ab.), Castay, Feb., 249.

JOINTS
Adipose tissue, Roentgen diagnostic importance of, J. Silbermann, Jan., 77 (80).
Air injection of joints, Technic of (ab.), R. Meyer-Wildisen, Feb., 260.
Changes in hemophilia, Joint, N. B. Newcomer, May, 573.
Normal first metatarso-phalangeal joint due to changes in direction of central ray, Variations in x-ray appearance of (ab.), B. S. Holmgren, April, 505.
Radiographic visualization of "true joint fissure," Conditions responsible for (ab.), W. Magnusson, Feb., 260.
Syphilis of bones and joints (ab.), F. A. Jostes and M. B. Roche, May, 645.

tuberculosis in
Bone tuberculosis, Unusual manifestations of, B. P. Widmann, H. W. Ostrum, and R. F. Miller, April, 434 (435).

KELOIDS
Roentgen therapy by method of Chaoul, E. P. Pendergrass, P. J. Hodes, and C. J. Garrahan, Feb., 142 (150).

KIDNEYS
Adipose tissue, Roentgen diagnostic importance of, J. Silbermann, Jan., 77 (85).
Agenesia of kidney, Retroperitoneal cyst with, K. Kornblum and J. A. Ritter, April, 416.
Carcinoma, Renal: study of 95 cases with follow-up notes on 36 (ab.), T. R. Fetter, April, 509.
Cystadenoma in double kidney, Malignant papillary (ab.), N. F. Ockerblad and H. E. Carlson, April, 510.
Diagnostic problems in surgical kidney disease (ab.), M. Muschat, April, 510.
Embryoma of kidney (Wilms' tumor), ab., W. E. Ladd, April, 510.
Heminephrectomy in disease of double kidney (ab.), E. Beer and W. H. Mencher, April, 509.
Kidneys, stunted growth, rickets, and disturbed cystine metabolism, Syndrome consisting of affections of (ab.), G. O. E. Lignac, March, 376.
Nephrolithiasis, Late results in conservative management of (ab.), J. T. Priestley and W. F. Braasch, March, 377.
Papilloma of kidney pelvis, Roentgenologic demonstration of (ab.), H. Keilhack, March, 377.
Perirenal fibrosarcoma (ab.), H. H. Howard and H. I. Suby, March, 377.
Perirenal insufflation (ab.), W. H. Mencher, Jan., 121.
Pyelitis in girls, Late effects of acute (ab.), L. R. Wharton, L. A. Gray, and H. G. Guild, April, 507.
Renal tuberculosis, Has excretory urography replaced retrograde pyelography in diagnosis of? (ab.), J. L. Emmett and W. F. Braasch, Jan., 128.
Tuberculosis, Renal (ab.), C. D. Donahue, May, 646.
Tumors, Renal (ab.), J. C. McClelland and J. R. F. Mills, March, 389.
Tumors, Renal: review of 130 cases (ab.), H. A. Soloway, March, 388.
Ureteric calculus, Radiological aspect of treatment of (ab.), D. G. Maitland, March, 368.
Urinary calculus, Brief review of 426 consecutive cases of (ab.), H. P. Winsbury-White, Feb., 251.

KNEE JOINT
Joint space at knee, Roentgen image of (ab.), R. Lohr and W. Hellpap, April, 511.

KYMOGRAPHY
Heart's ventricles, Systolic expansion of (ab.), A. C. Morelli, April, 508.
Normal colon, Roentgen kymography of: defecation in man (ab.), R. A. Rendich and L. A. Harrington, March, 371.
Pulmonary artery: roentgenographic and roentgen kymographic study, S. Brown, J. E. McCarthy, and A. Fine, Feb., 175.
Roentgen kymographic studies of aneurysms and mediastinal tumors (ab.), W. G. Scott and S. Moore, March, 377.

LARYNX
Carcinoma in pharynx and larynx, Treatment of, and results (ab.), L. Colledge, March, 370.
Carcinoma of larynx and hypopharynx, Results of roentgen and radium therapy in (ab.), R. Müller, April, 503.
Laryngocele (ab.), W. L. Simpson, May, 632.
Physiology and pathology of larynx, New applications of planigraphy to (ab.), Canuyt, Gunsett, and Greiner, May, 637.
Radiography of larynx, anterior view, and technic (ab), R. Ledoux-Lebard, J. Garcia-Calderon, and A. Djian, May, 632.
Tumors of larynx (ab.), F. A. Figi, May, 632.

LEUKEMIA
Chronic leukemia: study of incidence and factors influencing duration of life (ab.), B. S. Leavell, Jan., 118.
Pregnancy in case of lymphatic leukemia, Roentgen treatment of leukemia, with report of, E. K. Harrison and R. J. Reeves, March, 284.

LEUKOPENIA. *See* **Hemoclastic crisis.**

LIPIODOL
Lipiodol in treatment of persistent fecal fistula after appendectomy (ab.), S. N. Mendelsohn and L. H. Schriver, April, 501.
Sialography in non-neoplastic diseases of parotid gland, Application of, J. V. Blady and A. F. Hocker, Feb., 131.

LIPS, cancer
Cancer, Radium treatment of lip, at Radiological Clinic, Lund, Sweden, Review of 20 years' (ab.), A. Bergendal, Jan., 123.
Carcinoma of skin and lip, Early results of near distance radiation in (ab.), A. Hrabovszky, Feb., 254.
Carcinoma of skin and lip, Radium therapy of (ab.), J. Körbler, March, 383.
Roentgen therapy by method of Chaoul, E. P. Pendergrass, P. J. Hodes, and C. J. Garrahan, Feb., 142 (153).

LIVER
Polycythemia vera, Hepatic complications in (ab.), A. R. Sohval, April, 511.
Pyogenic liver abscess (ab.), E. L. Eliason, R. B. Brown, and D. P. Anderson, April, 511.

LUNGS
Abscesses, Diagnosis of extrapleural (ab.), G. Skarby, May, 633.
Abscess due to esophageal overflow, Lung (ab.), D. A. Sampson, May, 634.
Abscess of lung, Acute aerobic (non-putrid) (ab.), H. Neuhoff and A. S. W. Touroff, April, 512.
Acetylene gas, Roentgenological changes in lungs caused by (ab.), A. Renander, Jan., 119.
Anatomical structure of lungs, New conception of: pulmonary zones: clinical and radiological application (ab.), Pierret, P. Coulouma, A. Breton, and L. Devos, Jan., 119.
Artificial pneumothorax in children (ab.), P. F. Fitzpatrick, April, 513.
Asbestosis (ab), J. V. Sparkes, June, 747.

LUNGS—*Continued*
Atelectases of lungs and their sequences, Acute and chronic (ab.), R. Pohl, March, 379.
"Azotemic lung": radiographic study (ab.), C. Roubier, May, 634.
Bronchographic observation of re-expanded lungs following artificial pneumothorax, G. Zorzoli, May, 638.
Bronchopneumonia, Delayed resolution in (ab.), F. N. Cole, March, 382.
Bronchoscopy and esophagoscopy of importance in general practice, Phases of (ab.), V. J. Schwartz, Feb., 250.
Calcifications within lungs, Significance of (ab.), D. A. Rhinehart, March, 380.
Carcinoma, Bronchogenic: study of eight autopsied cases, W. E. Howes and S. G. Schenck, Jan., 8.
Carcinoma from pathologic and radiologic points of view, Primary bronchogenic (ab.), W. L. Mattick and E. M. Burke, Feb., 252.
Carcinoma of lung, Primary (ab.), M. O. Klotz, Feb., 252.
Carcinoma of lung, Roentgenographic images in primary, L. A. Hochberg, June, 713.
Childhood tuberculosis, Certain significant aspects of (ab.), R. M. Tyson, Jan., 127.
Cysts, Congenital lung: air expansile types (ab.), W. W. Anderson, May, 634.
Diseases of lungs in agricultural workers, Occupational (ab.), R. Fawcitt, April, 512.
Division of lung segments in right upper lobe (ab.), E. Behr and E. Huizinga, May, 635.
Dusts from lungs, Roentgenologic studies of excretion of (ab.), A. E. Barclay, K. J. Franklin, and R. G. Macbeth, March, 384.
Embolism, Roentgen diagnosis of lung (ab.), N. Westermark, May, 634.
Emphysema, Spontaneous mediastinal, with report of case associated with spontaneous pneumothorax, J. B. Morey and M. C. Sosman, Jan., 19.
Encapsulated left diaphragmatic pleurisy, Roentgen image of (ab.), H. Morr, March, 379.
Intrathoracic lesions, Density of central shadow in diagnosis of, L. G. Rigler, March, 316.
Lipoid pneumonia in infants and children, R. S. Bromer and I. J. Wolman, Jan., 1.
Lobar pneumonia, Resolving, in adults simulating tuberculosis in roentgenogram (ab.), S. Cohen, March, 382.
Lobar pneumonia, Roentgen therapy of (ab.), E. V. Powell, March, 382.
Massive atelectasis following cyclopropane anesthesia: report of cases and theory of cause and prevention (ab.), O. R. Jones and G. E. Burford, March, 378.
Osteo-arthropathy, pulmonary, Carcinoma of thymus, with marked, E. R. Miller, June, 651.
Pneumonias, Chronic (ab.), J. G. Scadding, May, 637.
Pneumothorax, Contralateral spontaneous, complicating artificial pneumothorax (ab.), J. B. Andosca, April, 513.
Pneumothorax, Diagnostic, S. Schnur, Feb., 198.
Pneumothorax, monolateral therapeutic, Regression of contralateral tuberculous lesions after (ab.), V. de Luca, May, 638.
Primary cancer of lung (ab.), D. S. King, April, 511.
Primary carcinoma of lung: clinical study of 160 cases in five years (ab.), A. Arkin, March, 379.
Primary neoplasms of lung, Radiation therapy in (ab.), R. E. Myers, March, 379.
Pulmonary artery: roentgenographic and roentgen kymographic study, S. Brown, J. E. McCarthy, and A. Fine, Feb., 175.
Pulmonary asbestosis. IV.—Asbestos body and similar objects in lung (ab.), K. M. Lynch, March, 380.
Pulmonary cyst with formation of separated peripheral shadows, Rapid evolution of (ab.), Brun, J. De Beaujeu, and Bège, April, 512.
Pulmonary cysts and emphysematous bullæ, Pathological physiology of (ab.), N. L. Kaltreider and W. W. Fray, May, 633.
Pulmonary [valve] in fibrothorax, Relative insufficiency of (ab.), N. Cavarozzi, Jan., 119.
Pulmonary pneumocyst: report of enormous solitary cyst in healthy adult female (ab.), G. Cheney and L. H. Garland, March, 378.
Pulmonary stratigraphy, Practical (ab.), C. Gaillard, June, 747.
Pulmonary tuberculosis, Spontaneous cure of some forms of (ab.), O. Maestri, April, 519.
Radiographic studies of excretion of dusts from lungs (ab.), A. E. Barclay, K. J. Franklin, and R. G. Macbeth, May, 635.
Radiography, Diagnostic value of pulmonary, in primary tuberculous angina: insufficiency of radioscopy (ab.), L. Weigel, May, 633.
Radiological disappearance of cavities immediately following phrenico-exeresis and their re-appearance after variable lapse of time (ab.), V. Basunti, April, 518.
Radiology in elucidation of hemoptysis, Value of (ab.), F. G. Wood, March, 378.
Respiratory efficiency, Tests of, and their correlation with radiological appearances in lungs (ab.), E. M. Killick, April, 511.
Roentgenography of pulmonary tuberculosis (ab.), H. E. Potter, April, 518.
Silicosis and carcinoma of lung, Association of (ab.), M. O. Klotz, May, 634.
Silicosis, Factors which determine diagnosis of (ab.), C. L. Sutherland, May, 643.
Silicosis in grinders (ab.), J. L. A. Grout, April, 516.
Silicosis in pottery industry (ab.), J. F. Bromley, April, 516.
Silicosis in pottery workers (ab.), R. A. K. Harper, April, 516.
Silicosis, Study of (ab.), P. B. Matz, March, 384.
Spontaneous rib fracture among tuberculous, Radiological study of (ab.), C. Sabbione, Jan., 127.
Stratigraphy of lungs and bones (ab.), Delaborde, June, 746.
Suppuration, Non-putrid pulmonary (ab.), M. L. Sussman, May, 633.
Thoracic diagnosis, Planigraphy—application to, W. E. Howes, May, 556.
Tuberculosis, Diagnosis and management of latent, suspected, and early clinical (ab.), H. W. Hetherington, April, 518.
Tuberculosis, Direct roentgen therapy through small fields of pulmonary (ab.), G. Faldella, April, 518.
Tuberculosis of intestines in tuberculous anthracosilicosis (ab.), R. Charr and A. C. Cohen, Jan., 126.
Tuberculous bronchogenic dissemination, Necessity for repeated roentgen investigation in late manifestations of (ab.), H. Bartsch and S. Zollner, March, 379.
Tuberculous pneumonia (ab.), J. W. Strayer, March, 382.
Tumor simulating subacromial bursitis, Superior pulmonary sulcus (ab.), L. Nathanson, L. A. Hochberg, and R. Perlman, March, 388.
Typhoid empyema: report of case operated upon and cured (ab.), A. C. Neto and J. Finocchiaro, Jan., 119.
Ulcerations of lung and pulmonary cavities, Tuberculous (ab.), B. Faccini, May, 634.
Unilateral pneumothorax, Effect of, on pre-existing tuberculous lesions in opposite lung (study of 200 cases), ab., U. de Michelis and E. Conte, April, 513.

LYMPH
X-ray inquiry into genesis of current of venous blood and lymph, K. Mayer, March, 275.

LYMPH NODES
Cervical lymph nodes in intra-oral carcinoma: surgery or irradiation? (ab.), J. J. Duffy, March, 370.

LYMPHATIC SYSTEM
Lymphatics (ed.), April, 491.
Roentgen treatment of leukemia, with report of pregnancy in case of lymphatic leukemia, E. K. Harrison and R. J. Reeves, March, 284.

LYMPHOBLASTOMA. *See* **Lymphogranuloma.**

LYMPHOGRANULOMA
Duodenum, Primary tumors of duodenum and jejunum and lymphogranuloma of (ab.), M. Cace, April, 519.
Hodgkin's disease of bones (ab.), H. S. Lieberman, March, 367.
Irradiation of cutaneous manifestations of lymphoblastoma (ab.), R. G. Pett, April, 520.
Malignant granulomas, Treatment of, by radiotherapy (ab.), R. Gilbert, May, 648.
Malignant granulomatosis, Radiculomedullary compression in course of (ab.), J. Froment, P. Croizat, and R. Masson, Jan., 125.

MASTOIDITIS
Acute mastoiditis (ab.), J. G. Parsons, May, 635.

MAXILLARY SINUS. *See* **Antrum.**

MEDALIST
Belot, J., Presentation of medal to, in Paris, Feb., 239.

MEDIASTINUM
Spontaneous mediastinal emphysema, with report of case associated with spontaneous pneumothorax, J. B. Morey and M. C. Sosman, Jan., 19.

MEDICINE
Who shall practise medicine? M. F. Cahal, May, 611.
X-ray in general practice, Value of (ab.), C. G. Sutherland, May, 646.

MELANIN, pigmentation
Melanosis coli (ab.), L. A. Buie, May, 642.

MELANOMA. *See* **Tumors, melanoma.**

MELANOSIS. *See* **Melanin, pigmentation.**

MENINGES, tumors
Meningiomas, Anterior basal (ab.), W. R. Henderson, Jan., 128.
Meningiomas: from roentgenological viewpoint (ab.), C. W. Schwartz, March, 389.

MENISCUS. *See* **Semilunar cartilage.**

MENSTRUATION
Menstrual dysfunctions and sterility, Roentgen treatment of: analysis of 108 cases, S. Bruck and J. M. Fruchter, April, 446.
Ovarian irradiation, Recovery following human, H. W. Jacox, May, 538.

MESOTHORIUM
Experimental production of sarcoma with radium and mesothorium (ab.), E. Uehlinger and O. Schürch, March, 383.

METRORRHAGIA. *See* **Uterus, hemorrhage.**

MIKULICZ' DISEASE
Sialography in non-neoplastic diseases of parotid gland, Application of, J. V. Blady and A. F. Hocker, Feb., 131 (139).

MILK, vitamin content
Milk, Effect of ultra-violet rays on vitamin C content of (ab.), H. Schroeder, Jan., 130.
MOUTH
Intra-oral carcinoma, Cervical lymph nodes in: surgery or irradiation? (ab.), J. J. Duffy, March, 370.
Leiomyoma of oral cavity (ab.), A. P. Stout, March, 387.
MUCOUS MEMBRANE
Ulcers of mucous membranes, *Aloe vera* in treatment of radiation, F. B. Mandeville, May, 598.
MULTIPLICITY
Carcinoma and venous thrombosis: frequency of association of carcinoma in body or tail of pancreas with multiple venous thrombosis (ab.), E. E. Sproul, June, 752.
Multiple heteromorphologic malignant tumors of uterus, H. W. Jacox, G. Major, and M. R. Baker, Jan., 51.
Primary malignant lesions, Occurrence of two or more, J. J. Collins, April, 462.
MYOSARCOMA. *See* **Sarcoma, myosarcoma.**

NECK
Carotid sinus syndrome, Use of roentgen therapy in, C. A. Stevenson, Feb., 209.
Cystic hygroma of neck (ab.), B. L. Fleming, Jan., 129.
NERVOUS SYSTEM
Carotid sinus syndrome, Use of roentgen therapy in, C. A. Stevenson, Feb., 209.
NITROGEN
X-rays, high voltage, in nitrogen, Scattering and photo-electric absorption of (ab.), H. C. Trueblood and D. H. Loughridge, May, 637.
NOSE
Broken noses, One hundred (ab.), J. W. Gerrie, March, 380.

OBELIA
Radiosensitivity and recurrent growth in *Obelia*, P. S. Henshaw, April, 466.
OBITUARY
Béclère, Dr. Antoine, April, 493.
Béclère, Antoine (1856–1939), A. U. Desjardins, May, 622.
Childs, Samuel Beresford, J. S. Bouslog, Feb., 239.
Cleghorn, Charles G., April, 495.
Jaches, Leopold, Marcy L. Sussman, April, 493.
Jackson, Byron H., June, 744.
Phillips, Clyde C., April, 493.
Schmitz, Henry, May, 625.
Schmitz, Henry, Edward L. Jenkinson, June, 743.
Wilkinson, Boyd E., May, 625.
ODONTOID. *See* **Atlas and axis.**
OILS, liver oils
Radiodermatitis and active ulceration, Several cases of, treated and cured by halibut liver ointment (ab.), Belot, Nahan, and Marquis, April, 514.
OPTIC CANAL
Radiography of optic canal, Simple procedure for (ab.), A. Bardy, Feb., 248.
ORTHOPEDICS
Pain in lower back, Orthopedic aspects of (ab.), L. W. Breck, Feb., 249.
OS CALCIS. *See* **Calcaneum.**
OSTEITIS
Luetic osteitis simulating malignant disease (ab.), A. H. Ungerman, W. H. Vicary, and W. W. Eldridge, April, 517.
OSTEITIS DEFORMANS
Paget's disease with diffuse involvement of small bones of extremities, Generalized form of (ab.), P. Harvier, J. Mallarmé, and G. Ledoux-Lebard, Feb., 250.
OSTEO-ARTHRITIS
Vertebral osteo-arthritis due to *Brucella melitensis* (ab.), H. Duclos, April, 517.
OSTEO-ARTHROPATHY
Pulmonary osteo-arthropathy, Carcinoma of thymus, with marked, E. R. Miller, June, 651.
OSTEOCHONDRITIS deformans juvenilis
Tibia vara, Adolescent, J. A. Siegling and J. B. Gillespie, April, 483.
Traumatic dislocation of hip followed by Perthes' disease (ab.), R. R. Goldenberg, March, 375.
OSTEOGENESIS IMPERFECTA. *See* **Bones, fragility.**
OSTEOMA. *See under* **Tumors.**
OSTEOMYELITIS
Spine, Acute infective osteomyelitis of (ab.), P. Turner, Jan., 124.
OSTEOPERIOSTITIS
Almost total osteoperiostitis associated with hypertrophy of palpebral tarsi, skin of face and extremities, Radiologic aspects of: new syndrome (ab.), J. N. Roy and A. Jutras, April, 502.
Arthritis, New surgical procedure in acute infectious (ab.), H. E. Hipps, Feb., 248.
OTITIS MEDIA
Acute otitis media, Evaluation of roentgen irradiation as adjunct in treatment of: preliminary report, A. H. Dowdy, C. A. Heatly, and W. W. Pierce, June, 661.
Septic patient with otitis media, Management of (ab.), J. H. Maxwell, Jan., 120.
OTORHINOLARYNGOLOGY
Oto-rhino-laryngological cancer by radiations, Indications and results of treatment of (ab.), L. Eloy, Feb., 253.

OVARY
Human ovarian irradiation, Recovery following, H. W. Jacox, May, 538.
OXYCEPHALY. *See* **Acrocephaly.**
OXYGEN
Tests of respiratory efficiency and their correlation with radiological appearances in lungs (ab.), E. M. Killick, April, 511.

PAGET'S DISEASE
of bones. *See* **Osteitis deformans.**
PALATE
Tumors of hard palate, Mixed (ab.), F. T. Hill, March, 389.
PANCREAS
Carcinoma and venous thrombosis: frequency of association of carcinoma in body or tail of pancreas with multiple venous thrombosis (ab.), E. E. Sproul, June, 752.
Enlargement of pancreas, Characteristic duodenal deformity in cases of different kinds of peri-vaterial (ab.), N. Frostberg, March, 381.
Roentgen diagnosis of diseases of pancreas (ab.), R. Pohl, March, 381.
PAPILLOMA. *See* **Tumors, papilloma.**
PARALYSIS, spinal
Paraplegia from erosion of vertebral column by large thoracic aneurysm, M. J. Hubeny and P. J. Delano, Feb., 171.
PARAPLEGIA. *See* **Paralysis, spinal.**
PAROTID GLAND
Radiography of parotid duct, L. W. Paul, May, 609.
Sialography in non-neoplastic diseases of parotid gland, Application of, J. V. Blady and A. F. Hocker, Feb., 131.
PAROTITIS
Parotid gland, Application of sialography in non-neoplastic diseases of, J. V. Blady and A. F. Hocker, Feb., 131.
PELVIMETRY
Obstetrics, Practical employment of radiographic diagnosis in (ab.), P. Brault and A. Tizon, April, 508.
Roentgenographic pelvimetry and fetalometry: elimination of errors due to movements between x-ray exposures, W. W. Fray and W. T. Pommerenke, March, 261.
Roentgen-ray pelvimetry (ab.), C. T. Hayden, Jan., 120.
X-ray pelvimetry (ab.), A. Orley, Jan., 120.
PEPTIC ULCER
Double ulcer of stomach: radiographs and specimen (ab.), V. Paschetta, May, 636.
Esophagus, Peptic ulcer of (ab.), F. Norgaard, May, 636.
Gastroduodenal hemorrhage, Problem of (ab.), A. M. Snell, May, 636.
Internal medical treatment of gastric and duodenal ulcers, Limitations of (ab.), H. Müller, March, 381.
Jejunal peptic ulcer, Insufflation of colon as method of diagnosis in gastrocolic fistula following post-operative (ab.), L. Weigel, May, 637.
Multiple ulcers of stomach and duodenum (ab.), P. Savy, M. Girard, and Z. Khayat, Jan., 121.
Peptic ulcer based on necropsy records, Study of (ab.), S. A. Portis and R. H. Jaffé, Jan., 120.
Peptic ulcer of esophagus (ab.), J. Terracol, P. Lamarque, and P. Bétoulières, Jan., 121.
Peptic ulcer treated by posterior pituitary extract (ab.), M. H. Metz and R. W. Lackey, Jan., 120.
Perforated peptic ulcer, Late results of surgical treatment in (ab.), J. V. Cable, March, 381.
Radiologic characteristics of so-called "large duodenal ulcer" (ab.), D. S. Bartstra, May, 636.
PERITONITIS
Acute peritonitis and other infections, Roentgen treatment of, with mobile x-ray apparatus, J. F. Kelly and D. A. Dowell, June, 675.
PERTHES' DISEASE
Tibia vara, Adolescent, J. A. Siegling and J. B. Gillespie, April, 483. *See also* **Osteochondritis deformans juvenilis.**
PHARYNX
Carcinoma in pharynx and larynx, Treatment of, and results (ab.), L. Colledge, March, 370.
Carcinoma of hypopharynx, Results of radiation therapy in (ab.), E. Bandhauer, Feb., 252.
Carcinoma of larynx and hypopharynx, Results of roentgen and radium therapy in (ab.), R. Müller, April, 503.
PHRENICO-EXERESIS
Radiological disappearance of cavities immediately following phrenico-exeresis and their re-appearance after variable lapse of time (ab.), V. Basunti, April, 518.
PHYSICAL THERAPY
Fever therapy in gonococcal infections, W. Bierman and C. L. Levenson, April, 454.
Roentgen radiation from tube actuated by Van de Graaf generator, Physical measurements on, J. C. Hudson, May, 530.
PITRESSIN
Radiography after injection of pitressin, Several cases of: experimental proofs (ab.), P. C. Smyrniotis, Jan., 122.
PITUITARY BODY
Hypophysis, Case of hemorrhagic metritis cured by roentgen irradiation of (ab.), J. Moro and Monmignaut, April 507.
preparations
Peptic ulcer treated by posterior pituitary extract (ab.), M. H. Metz and R. W. Lackey, Jan., 120.

PITUITARY BODY, preparations—*Continued*
Pituitrin on evacuation of stomach, Influence of (ab.), R. I. Levina, Jan., 126.
Posterior pituitary extract, Gastric lesion produced by (ab.), M. H. Metz, Jan., 125.
roentgenography
X-ray examination of sella turcica in sagittal positions, Value of, P. L. Fariñas, April, 411.
PLACENTA PREVIA
Diagnosis of placenta previa, Roentgenologic: indirect placentography (ab.), W. H. Ude, J. A. Urner, and F. O. Robbins, June, 749.
PLANIGRAPHY
Computation of dimensions in planigraphy with mathematical instruments, D. H. Drummond and W. W. Schmela, May, 550.
Image formation, Fundamental property of planigraphic (ab.), R. H. De Waard, May, 637.
Larynx, New applications of planigraphy to physiology and pathology of (ab.), Canuyt, Gunsett, and Greiner, May, 637.
Thoracic diagnosis, Planigraphy—application to, W. E. Howes, May, 556.
PLEURISY
Encapsulated left diaphragmatic pleurisy, Roentgen image of (ab.), H. Morr, March, 379.
PNEUMOCONIOSIS
Pulmonary asbestosis. IV.—Asbestos body and similar objects in lung (ab.), K. M. Lynch, March, 380.
Tuberculosis of intestines in tuberculous anthracosilicosis (ab.), R. Charr and A. C. Cohen, Jan., 126.
PNEUMONIA
Bronchopneumonia, Delayed resolution in (ab.), F. N. Cole, March, 382.
Chronic pneumonias (ab.), J. G. Scadding, May, 637.
Intrathoracic lesions, Density of central shadow in diagnosis of, L. G. Rigler, March, 316 (318).
Lipoid pneumonia in infants and children, R. S. Bromer and I. J. Wolman, Jan., 1.
Lobar pneumonia, Resolving, in adults simulating tuberculosis in roentgenogram (ab.), S. Cohen, March, 382.
Lobar pneumonia, Roentgen therapy of (ab.), E. V. Powell, March, 382.
Roentgen treatment of acute peritonitis and other infections with mobile x-ray apparatus, J. F. Kelly and D. A. Dowell, June, 675.
Tuberculous pneumonia (ab.), J. W. Strayer, March, 382.
PNEUMONITIS
Thoracic diagnosis, Planigraphy—its application to, W. E. Howes, May, 556 (565).
PNEUMOTHORAX
Artificial pneumothorax, Bronchographic observation of re-expanded lungs following (ab.), G. Zorzoli, May, 638.
Artificial pneumothorax in children (ab.), P. F. Fitzpatrick, April, 513.
Carcinoma of thymus, with marked pulmonary osteoarthropathy, E. R. Miller, June, 651 (655).
Contralateral spontaneous pneumothorax complicating artificial pneumothorax (ab.), J. B. Andosca, April, 513.
Diagnostic pneumothorax, S. Schnur, Feb., 198.
Emphysema, Spontaneous mediastinal, with report of case associated with spontaneous pneumothorax, J. B. Morey and M. C. Sosman, Jan., 19.
Monolateral therapeutic pneumothorax, Regression of contralateral tuberculous lesions after (ab.), V. de Luca, May, 638.
Thoracic diagnosis, Planigraphy—its application to, W. E. Howes, May, 556 (561).
Unilateral pneumothorax, Effect of, on pre-existing tuberculous lesions in oposite lung (study of 200 cases), ab., U. de Michelis and E. Conte, April, 513.
POISON and POISONING
Radium poisoning and tolerance dose of radium, Researches in problem of, B. Rajewsky, Jan., 57.
POLYCYTHEMIA
Course of polycythemia (ab.), N. Rosenthal and F. A. Bassen, April, 502.
Hepatic complications in polycythemia vera (ab.), A. R. Sohval, April, 511.
PREGNANCY
Diagnosis of pregnancy, Plea for more frequent use of lateral roentgenogram in, M. J. Hubeny and P. J. Delano, May, 546.
Metrorrhagia cured by radiotherapy: subsequent pregnancy (ab.), Dano and Lainé, April, 507.
Obstetrics, Practical employment of radiographic diagnosis in (ab.), P. Brault and A. Tizon, April, 508.
Pregnancy in case of lymphatic leukemia, Roentgen treatment of leukemia, with report of, E. K. Harrison and R. J. Reeves, March, 284.
PROSTATE
Carcinoma of prostate, Metastases from occult (ab.), O. S. Culp, April, 513.
Opacity in prostate, Case of large (ab.), F. Bernasconi, C. Viallet, and R. Marchioni, April, 513.
Sarcoma of prostate and adjacent retrovesical structures (ab.), E. Hess, April, 513.
PROSTIGMIN
Abdominal roentgenography, Use of prostigmin as preparation for (ab.), M. J. Farrell, Jan., 123.
PRURITUS ANI
Roentgen therapy by method of Chaoul, E. P. Pendergrass, P. J. Hodes, and C. J. Garrahan, Feb., 142 (152).
PYELITIS
Acute pyelitis in girls, Late effects of (ab.), L. R. Wharton, L. A. Gray, and H. G. Guild, April, 507.
PYELOGRAPHY
Diagnostic problems in surgical kidney disease (ab.), M. Muschat, April, 510.
Embryoma of kidney (Wilms' tumor), ab., W. E. Ladd, April, 510.
Intravenous pyelography, Acute iodism following (ab.), Lamarque, Guibal, and Bétoulières, April, 504.
Radiological aspect of treatment of ureteric calculus (ab.), D. G. Maitland, March, 368.
Renal carcinoma: study of 95 cases with follow-up notes on 36 (ab.), T. R. Fetter, April, 509.
Renal tuberculosis, Has excretory urography replaced retrograde pyelography in diagnosis of? (ab), J. L. Emmett and W. F. Braasch, Jan., 128.
Ureters, Two cases of cystic dilatation of lower thirds of left (ab.), E. Herskowits, April, 507.
PYLORUS
Cancer, Two cases of gastric: difficulty of radio-diagnosis of lesions of pyloric antrum (ab.), P. Vasselle, March, 369.
Invagination of pylorus into duodenum, Unusual case of (ab.), L. Galifi, Feb., 255.

RADIATION
Cerenkov radiation (ab.), G. B. Collins and V. G. Reiling, May, 637.
Efficiency curves in quantitative radiobiology, W. H. Love, June, 708.
Fibromas, Involution of uterine cavity after irradiation of (ab.), Guilbert, Tortat, Frain, and Le Guern, May, 649.
Fractures, Some experimental studies of action of short waves on process of healing of (ab.), E. Fischel, Feb., 258.
Gynecology, Radiation therapy in (ab.), S. Mitra, March, 384.
Heterogeneous beam of roentgen rays, Spectral distribution of (ab.), G. Grossmann, Jan., 122.
High voltage x-rays in nitrogen, Scattering and photo-electric absorption of (ab.), H. C. Trueblood and D. H. Loughridge, May, 637.
Inflammatory conditions, Radiation therapy in acute and chronic (ab.), H. J. Ullmann, May, 631.
Intra-oral carcinoma, Cervical lymph nodes in: surgery or irradiation? (ab.), J. J. Duffy, March, 370.
Mutual interest to general practitioner and radiologist, Points of (ab.), W. A. Jones, Jan., 122.
Potential in deep therapy, Problem of (ab.), L. Graf and J. Graf, Jan., 122.
Radiation quality factors and depth, Relation between, A. Mutscheller, Jan., 87.
Radiobiological experiments with pupæ of *Drosophila* (ab.), A. Liechti, W. Minder, and J. H. Müller, April, 502.
Sarcomas, Results of radiation therapy in (ab.), O. Walther, May, 642.
Tumor variants and their influence upon radiosensitivity, Some histological, I. A. B. Cathie, April, 425.
burns and injuries
Aloe vera in treatment of radiation ulcers of mucous membranes, F. B. Mandeville, May, 598.
effects
Biologic effect of roentgen rays (ab.), J. A. Crowther, Feb., 249.
Radiosensitivity and cell division (ab.), W. Luther, Feb., 249.
mitogenetic
Mitogenetic radiation, Present status of, A. Hollaender, April, 404.
therapy
Adamantinoma of tibia (ab.), B. Wolfort and D. Sloane, March, 389.
Carcinoma of breast, Value of radiation in treatment of, L. G. Allen, Jan., 63.
Co-relation of physical and clinical data in radiation therapy, W. H. Meyer, Jan., 23.
Lip cancer at Radiological Clinic, Lund, Sweden, Review of 20 years' radium treatment of (ab.), A. Bergendal, Jan., 123.
Tumors of hard palate, Mixed (ab.), F. T. Hill, March, 389.
Uterus, Multiple heteromorphologic malignant tumors o H. W. Jacox, G. Major, and M. R. Baker, Jan., 51.
RADIO-ACTIVITY
Neutron production and production of artificial radio-activity, Technic of (ab.), A. Bouwers, April, 501.
RADIOLOGICAL SOCIETY OF NORTH AMERICA, Annual Meeting, 1938, Held in Pittsburgh, Jan. 110; Next Annual Meeting, April, 492.
RADIOLOGIST
Economic status of radiologist under socialized medicine: report on Germany, S. W. Donaldson, March, 351.
Economic status of radiologist under socialized medicine: report on England, S. W. Donaldson, April, 486.
Language of engineers and radiologists: new x-ray terms proposed: rhegma, rhothion, kludon, plem, aith, R. R. Newell, March, 270.
Mutual interest to general practitioner and radiologist, Points of (ab.), W. A. Jones, Jan., 122.
Partnerships of radiologists (ed.), T. A. Groover, May, 617.

Responsibility of radiologist in training of hospital intern in fluoroscopy (ed.), R. Golden, Feb., 235.

RADIOLOGY
General welfare of radiology, M. F. Cahal, Jan., 98.
Planning and organization of radiological department in general hospital, Discussion on (ab.), R. S. Paterson, J. S. Fulton, and R. J. Sankey, May, 639–641.
Presidency, Passing on (ed.), H. R. Schinz, Jan., 105.

RADIUM
Aloe vera in treatment of radiation ulcers of mucous membranes, F. B. Mandeville, May, 598.
Bladder carcinoma, Radium therapy of: five-year results, failures, and future therapy (ab.), B. S. Barringer, May, 641.
Cancer of cervix: therapeutic and biological thoughts (ab.), S. Laborde, April, 520.
Carcinoma, Development of treatment methods for uterine, at Women's Clinic of University of Würzburg (ab.), T. C. Neeff, May, 649.
Carcinoma of breast, Value of radiation in treatment of, L. G. Allen, Jan., 63.
Carcinoma of cervix and breast: prognosis and preferable therapy (ab.), E. D. Greenberger, March, 370.
Carcinoma of cervix, Radium therapy of (ab.), K. Wasserburger and H. Smereker, Jan., 122.
Carcinoma of cervix, Results and experiences in treatment of, with special consideration of radium therapy (ab.), P. Caffier, May, 649.
Carcinoma of cervix, Results in treatment of, at Women's Clinic of University of Göttingen from 1926 to 1937 (ab.), F. Erichsen, April, 520.
Carcinoma of cervix, Treatment of, in Women's Clinic of University of Königsberg from 1910 to 1937 (ab.), F. v. Mikulicz-Radecki, March, 390.
Carcinoma of cervix uteri, Treatment of (ab.), R. E. Myers, March, 369.
Carcinoma of hypopharynx, Results of radiation therapy in (ab.), E. Bandhauer, Feb., 252.
Carcinoma of larynx and hypopharynx, Results of roentgen and radium therapy in (ab.), R. Müller, April, 503.
Carcinoma of pharynx and larynx, Treatment of, and results (ab.), L. Colledge, March, 370.
Carcinoma of skin and lip, Radium therapy in (ab.), J. Körbler, March, 383.
Carcinoma of skin and lip, Early results of near distance radiation in (ab.), A. Hrabovszky, Feb., 254.
Carcinoma of uterine cervix (ab.), H. H. Bowing and R. E. Fricke, May, 649.
Carcinoma of uterus, Avoidance of injurious effects on bladder in radiation therapy of (ab.), T. C. Neeff and F. Hoff, June, 749.
Carcinoma of uterus, Thirty years' experience in treatment of (ab.), A. Mayer, March, 390.
Carcinoma, Present method of radiation therapy of uterine, in first gynecological clinic of University of Munich (ab.), F. G. Dietel, May, 650.
Cervix carcinoma, Early results in, from single and divided doses of roentgen radiation (ab.), A. N. Arneson, March, 371.
Cervix uteri, Factors relating to treatment of (ab.), G. H. Johnson, March, 390.
Collum carcinoma, Results obtained in radiation treatment of inoperable (ab.), I. de Büben, March, 370.
Cystic hygroma of neck (ab.), B. L. Fleming, Jan., 129.
Danger of introducing radio-active substances into body of mammals: experience with two mares (ab.), T. Nogier, May, 642.
Dosage in radiation therapy in simple terms, Value of assessing and prescribing, R. Paterson, Feb., 221.
Dosage measurements by simple computations, H. M. Parker, May, 591.
Effects, Biological, of alpha rays, with special consideration of problems of radium therapy using extremely low doses (ab.), K. Inouye, May, 641.
Experimental production of sarcoma with radium and mesothorium (ab.), E. Uehlinger and O. Schürch, March, 383.
Fibroids, Pretended responsibility of roentgen therapy for sarcomatous degeneration of irradiated (ab.), G. Daniel, May, 650.
Fungus infections, Radiation therapy of (ab.), D. Spangler, March, 375.
Greinacher "spark" counter for measurement of very small quantities of roentgen and radium rays (ab.), A. Leichti, Feb., 248.
Gynecological radium therapy, Development of, especially in treatment of non-malignant disease (ab.), C. J. Gauss, May, 642.
Hemangiomas, Radium therapy of (ab.), W. Baensch, April, 515.
Hemorrhoids and ano-rectal angiomas in infants (ab.), A. Bensaude and F. Bertillon, Jan., 123.
Intra-uterine radium therapy of hemorrhagic metropathies (ab.), A. Pickhan, May, 641.
Leukopenia, Therapy of x-ray (ab.), C. Carrié, April, 515.
Lip cancer at Radiological Clinic, Lund, Sweden, Review of 20 years' radium treatment of (ab.), A. Bergendal, Jan., 123.
Mastitis and breast cancer, Chronic: family history of five sisters (ab.), S. W. Hadley, Feb., 250.
Myoma uteri, Treatment of (ab.), T. B. Lee, May, 650.
Oto-rhino-laryngological cancer by radiations, Indications and results of treatment of (ab.), L. Eloy, Feb., 253.
Plantar wart (ab.), W. Kelton, April, 520.
Primary and secondary beta rays in radium therapy, Significance of (ab.), W. Minder, March, 383.
Radio-active emanation, Therapy with (ab.), H. Hirschi and H. Bodmer, April, 515.
Radiobiology and radiation therapy (ab.), A. Gunsett, April, 514.
Radium bomb, Is it possible to use, for intravaginal treatment of carcinoma of uterus and would it be possible to improve considerable distribution of radiation? (ab.), R. du Mesnil de Rochemont, April, 515.
Radium, poisoning and tolerance dose of radium, Researches in problem of, B. Rajewsky, Jan., 57.
Radium therapy, Construction of superficial applicators for (ab.), R. Paterson and W. MacVicar, April, 515.
Roentgen therapy by method of Chaoul, E. P. Pendergrass, P. J. Hodes, and C. J. Garrahan, Feb., 142 (150).
Roentgen therapy, Dosage and method of, for inflammatory conditions, A. U. Desjardins, June, 699.
Skin malignancy, Treatment of, by irradiation (ab.), H. W. Jacox, March, 369.
Soluble radium, injected into animal, distributed in various body tissue, How is? (ab.), F. Daels, March, 383.
Superficial radiotherapy: contact radiotherapy (Chaoul) (ab.), W. Gassmann, May, 639.
Tumors of larynx (ab.), F. A. Figi, May, 632.
Uterine fibroids, Use of radium in treatment of (ab.), L. Feid, Jr., Jan., 122.
Uterine hemorrhage, Radiotherapy in non-malignant (ab.), B. Windeyer, May, 631.
X-ray treatment of operable cancer of breast, Technic of, based upon analysis of Keynes' radium technic, J. R. Andrews, March, 294.

RECTUM
Hemorrhoids and ano-rectal angiomas in infants (ab.), A. Bensaude and F. Bertillon, Jan., 123.
Melanosis coli (ab.), L. A. Buie, May, 642.
Rectal symptoms from general surgeon's standpoint (ab.), H. B. Stone, May, 642.

RESPIRATION
Tests of respiratory efficiency and their correlation with radiological appearances in lungs (ab.), E. M. Killick, April, 511.

RETICULO-ENDOTHELIAL SYSTEM
Irradiation of reticulo-endothelial tissue with small doses of roentgen rays, Studies on (ab.), S. A. Chrom, April, 501.

RETROPERITONEAL CYST. *See* **Abdomen.**

RIBS, fractures
Spontaneous rib fracture among tuberculous, Radiologica study of (ab.), C. Sabbione, Jan., 127.

ROENTGEN RAYS, biologic effects
Biologic effect of roentgen rays (ab.), H. Holthusen, April, 514.

burns and injuries
Acute roentgen injury, Report of (ab.), K. Hoede, April, 514.
Aloe vera in treatment of radiation ulcers of mucous membranes, F. B. Mandeville, May, 598.
Leukopenia, Therapy of x-ray (ab.), C. Carrié, April, 515.
Radiodermatitis and active ulceration, Several cases of, treated and cured by halibut liver ointment (ab.), Belot, Nahan, and Marquis, April, 514.
Roentgen late injuries (ab.), F. John, April, 515.
Tracheal stenosis from roentgen therapy (ab.), L. H. Clerf and F. J. Putney, April, 514.

costs
X-ray rentals in hospitals: analysis of current rental costs in hospitals and medical buildings, L. H. Garland, Jan., 46.

effects
Cyclic character of effect of roentgen rays (ab.), L. Neu and V. Neu, April, 514.

examination
Abdomen, Diagnosis of unusual calcareous shadows found on x-ray films of, C. B. Rose, May, 600.
Abdominal roentgenography, Use of prostigmin as preparation for (ab.), M. J. Farrell, Jan., 123.
Abscesses, Diagnosis of extrapleural (ab.), G. Skarby, May, 633.
Accessory nasal sinuses by roentgen study, Diagnosis of diseases of (ab.), L. Stehr, March, 385.
Acetylene gas, Roentgenological changes in lungs caused by (ab.), A. Renander, Jan., 119.
Acute osteoporosis, Roentgen therapy in (ab.), E. B. Mumford, March, 367.
Adamantinoma of tibia (ab.), B. Wolfort and D. Sloane, March, 389.
Adipose tissue, Roentgen diagnostic importance of, J. Silbermann, Jan., 77.
Amebic infections of large bowel, Further consideration of roentgen-ray manifestations in, J. C. Bell, March, 332.
Aneurysms and mediastinal tumors, Roentgen kymographic studies of (ab.), W. G. Scott and S. Moore, March, 377.
Aneurysm, Clinical aspect of (ab.), J. H. Mills and B. T. Horton, June, 746.
Aneurysm of aorta, Dissecting: clinical recognition (ab.), A. J. Patek, April, 509.
Aneurysm of heart wall, Instructive case of, with "teeter-movement" symptom (ab.), L. Bischoff, June, 746.

ROENTGEN RAYS, examination—*Continued*

Aneurysms of internal carotid artery in cavernous sinus, Saccular (ab.), G. Jefferson, April, 508.
Aneurysm, Paraplegia from erosion of vertebral column by large thoracic, M. J. Hubeny and P. J. Delano, Feb., 171.
Angiomas, Calcification in (ab.), F. Y. Khoo, Jan., 128.
Anomalies of spine (ab.), W. Bailey and R. A. Carter (ab)., Jan., 125.
Anterior basal meningiomas (ab.), W. R. Henderson, Jan., 128.
Antrum, Inorganic lacunar images of (ab.), P. Porcher March, 386.
Apparatus, mobile x-ray, Roentgen treatment of acute peritonitis and other infections with, J. F. Kelly and D. A. Dowell, June, 675.
Appendicitis and x-ray study, Chronic (ab.), H. Lossen, April, 501.
Arthritis of shoulder, Chronic (ab.), J. G. Kuhns, Feb., 248.
Asbestosis (ab.), J. V. Sparkes, June, 747.
Atelectases of lungs and their sequences, Acute and chronic (ab.), R. Pohl, March, 379.
Barium enemas to disclose latent intestinal tuberculosis in cases with pulmonary tuberculosis, Necessity for systematic use of (ab.), M. Picard, Jan., 128.
Benign giant-cell tumor of bone, Roentgen diagnosis and treatment of (ab.), J. A. Meadows and K. F. Kesmodel, March, 367.
Biotome of Bocage and of planigraph of Ziedses des Plantes, Presentation of (ab.), J. Massiot, June, 747.
Bladder, Dermoid cyst of (ab.), A. Lidzki, June, 749.
Bladder tumors, Radiological diagnosis of (ab.), W. Sitkowski, June, 749.
Bone changes in primary hypogonadism, L. M. Hurxthal and H. F. Hare, May, 521.
Bone syphilis, Roentgenological manifestations in (ab.), D. M. Stewart, April, 518.
Bone tuberculosis, Unusual manifestations of, B. P. Widmann, H. W. Ostrum, and R. F. Miller, April, 434.
Breast lesions by means of contrast media, Roentgen visualization and diagnosis of (ab.), N. F. Hicken, R. R. Best, H. B. Hunt, and T. T. Harris, March, 368.
Brodie's abscess and differential diagnosis (ab.), J. F. Brailsford, Feb., 249.
Bronchial asthma, Roentgen studies of pathological physiology of (ab.), L. G. Rigler and R. Koucky, June, 748.
Bronchial stenosis, Rôle of inflammatory, in etiology of bronchiectasis (ab.), P. H. Holinger, June, 749.
Bronchial tree, Anatomy of, and clinical application, J. H. Neil, W. Gilmour, F. J. Gwynne, W. Main, and W. A. Fairclough, June, 750.
Bronchiectasis, Bilateral lobectomy for (ab.), D. E. Ross, June, 750.
Bronchiectasis, Further experience with roentgen therapy for, M. Berck and W. Harris, June, 693.
Bronchographic observation of re-expanded lungs following artificial pneumothorax (ab.), G. Zorzoli, May, 638.
Bronchopneumonia, Delayed resolution in (ab.), F. N. Cole, March, 382.
Bronchoscopy and esophagoscopy of importance in general practice, Phases of (ab.), V. J. Schwartz, Feb., 250.
Bronchostenosis: roentgenological study (ab.), N. Westermark, June, 750.
Calcifications in breast, Extensive (ab.), A. Kubat, March, 368.
Calcification of bursa of coracoclavicular ligament (ab.), H. J. McCurrich, April, 503.
Calcified aortic stenosis, Isolated (ab.), W. F. Friedewald and A. R. Ewing, Feb., 259.
Calcified fecalith in appendix: report of case of acute suppurative appendicitis perforated by calcified fecalith (ab.), H. J. Shelley, April, 502.
Calcified scrotal tumor, A. Fine and S. Brown, Jan., 92.
Calculi, Differential diagnosis of biliary and urinary (ab.), H. Pons, June, 751.
Calculus of gall bladder with suppuration, Large (ab.), E. Binet and Dillenseger, Feb., 251.
Cancer of lung, Primary (ab.), D. S. King, April, 511.
Cancer of stomach, Early diagnosis of (ab.), L. J. Notkin, June, 752.
Cancer of stomach, Symptoms, diagnosis, and treatment of (ab.), J. S. Horsley, March, 385.
Cancer of transverse colon of masked type (ab.), A. Cade and M. Milhaud, March, 371.
Cancer, Remarks on vertebral (ab.), F.-G. Marill, R. Raynaud, and A. Huguenin, April, 517.
Carcinoma, Bronchogenic: study of eight autopsied cases, W. E. Howes and S. G. Schenck, Jan., 8.
Carcinoma from pathologic and radiologic points of view, Primary bronchogenic (ab.), W. L. Mattick and E. M. Burke, Feb., 252.
Carcinoma of lung, Roentgenographic images in primary, L. A. Hochberg, June, 713.
Carcinoma of thymus, with marked pulmonary osteoarthropathy, E. R. Miller, June, 651.
Cardiac end of stomach simulating soft tissue tumefaction in supine position, Shadow of, L. Nathanson, April, 473.
Cardiac enlargement, Diagnosis of (ab.), W. Frey, April, 509.
Cardiospasm: report of case, M. Golob, April, 481.
Carpal scaphoid and trapezium with subluxation and foreshortening of first metacarpal, Traumatic axial rotation by gear movement of (ab.), A. A. Schmier and M. S. Burman, March, 390.
Cervical spine, Three cases of injury to, including one of unrecognized fracture of odontoid (ab.), Brillouet and A. Viel, March, 372.
Chest, Skiagraphy of (ab.), G. Jessel, Jan., 119.
Childhood tuberculosis, Certain significant aspects of (ab.), R. M. Tyson, Jan., 127.
Cholecystography, Danger of intravenous (ab.), W. Lutz and H. Seyfried, April, 506.
Cholecystography: single-dose *versus* double-dose methods of administering dye, M. Feldman, Feb., 155.
Chordoma, with report of two cases (ab.), R. F. Ridpath, March, 387.
Chronic intestinal amebiasis, Diagnosis of (ab.), M. Poirot, March, 376.
Coccidioides infection (coccidioidomycosis). II.—Primary type of infection (ab.), E. C. Dickson and M. A. Gifford, April, 509.
Cold screening in low-power radiography (ab)., S. T. Li, April, 501.
Colitis, Right-sided (regional), ab., B. B. Crohan and A. A. Berg, Jan., 117.
Colon, Case of genuine invagination of (ab.), B. S. Holmgren, Feb., 254.
Colon disorders, Fundamentals in surgical treatment of (ab.), L. M. Larson, Feb., 254.
Colon, Roentgen kymography of normal: defecation in man (ab.), R. A. Rendich and L. A. Harrington, March, 371.
Common duct stones, Non-operative management of remaining (ab)., R. R. Best and N. F. Hicken, Feb., 251.
Coxofemoral region, Voluminous osteogenic sarcoma of left (ab.), Carteret, Dillenseger, and P. Bertrand, May, 643.
Deformities of hip joint in children (ab.), C. G. Teall, March, 374.
Diagnostic problems in surgical kidney disease (ab.), M. Muschat, April, 510.
Diaphragmatic hernia (ab.), E. M. Jones, March, 373.
Diverticula of digestive tract, Multiple (ab.), G. Ronneaux and Witasse, April, 506.
Diverticulum of duodeno-jejunal angle (ab.), G. Dumont, April, 506.
Duodenum, Diverticulum of (ab.), D. Wheeler, Feb., 255.
Dusts from lungs, Roentgenologic studies of excretion of (ab.), A. E. Barclay, K. J. Franklin, and R. G. Macbeth, March, 384.
Echinococcus of spine, Case of, difficult to interpret roentgenologically (ab.), C. Guidotti, May, 645.
Embryoma of kidney (Wilms' tumor), ab., W. E. Ladd, April, 510.
Emphysema, Spontaneous mediastinal, with report of case associated with spontaneous pneumothorax, J. B. Morey and M. C. Sosman, Jan., 19.
Encapsulated left diaphragmatic pleurisy, Roentgen image of (ab.), H. Morr, March, 379.
Enteritis, Regional (ab.), J. V. Prouty, March, 376.
Esophagopleural fistula, with report of case, J. R. Phillips, Jan., 91.
Esophagus, Peptic ulcer of (ab.), F. Norgaard, May, 636.
Esophagus rupture of, from blow on abdomen, C. A. Aldrich and W. E. Anspach, Jan., 93.
Fibroma of stomach, True (ab.), C. B. Udaondo, E. Finochietto, and D. Mosto, May, 647.
Focal (dental) infection, Diagnosis of, especially by means of roentgenogram (ab.), W. Praeger, Feb., 255.
Fracture of atlas in automobile accidents: value of x-ray views for diagnosis (ab.), H. F. Plaut, March, 372.
Fractures of os calcis (ab.), D. C. McKeever, April, 505.
Fractures, Reduction of, under roentgenoscopic control: two instructive examples (ab.), H. Tillier, March, 372.
Gall bladder, Error in technic in administration of tetraiodide with intolerance and prolonged visibility of (ab.), Nemours-Auguste, April, 505.
Gallstones, Formation transparent of gas-filled fissures in, and their significance for radiological diagnosis (ab.), Å. Åkerlund, June, 751.
Gas gangrene, Radiological aspects of early and advanced (ab.), A. Grili, April, 506.
Gastric and duodenal ulcers, Limitations of internal medical treatment of (ab.), H. Müller, March, 381.
Gastric cancer, Two cases of: difficulty of radio-diagnosis of lesions of pyloric antrum (ab.), P. Vasselle, March, 369.
Gastric cancer, X-ray diagnosis of (ab.), A. J. Delario, June, 752.
Gastric syphilis, pseudo-neoplastic type: clinical and radiologic study (ab.), H. Marc and Sire, May, 645.
Gastric syphilis, Two cases of (ab.), P. A. Blinkenberg, May, 645.
Gastritis, Roentgenologic consideration of, M. Feldman, June, 726.
Gastrocolic fistula, W. Bailey and W. V. Knoll, March, 347.
Gastro-intestinal tract, Radiology of: value of co-operation (ab.), S. J. Borland, April, 506.
Genesis of current of venous blood and lymph, X-ray inquiry into, K. Mayer, March, 275.
Head injury, Unusual (ab.), C. K. Fuller, March, 385.
Heart at puberty, Size, variability, and correlation of (ab.), G. Marzocchi, Feb., 259.
Heart, Radiological examination of (ab.), L. E. Rothstadt, March, 373.

Heart's ventricles, Systolic expansion of (ab.), A. C. Morelli, April, 508.
Hemangioma of vertebræ, Radiation therapy of primary (ab.), I. H. Lockwood and C. E. Bell, May, 644.
Heminephrectomy in disease of double kidney (ab.), E. Beer and W. H. Mencher, April, 509.
Hemoptysis, Value of radiology in elucidation of (ab.), F. G. Wood, March, 378.
Hernia, Esophageal hiatus, with special reference to x-ray diagnosis (ab.), D. Eisen, Feb., 257.
Hiatal hernia (ab.), H. J. Moersch, March, 374.
Hip joint presenting lesions of post-traumatic coxarthritis, Acute arthritis developing in (ab.), Lamarque and Bétoulières, March, 374.
Historadiography (ab.), P. Lamarque, April, 501.
Hyperostosis syndrome, Frontal (ab.), H. M. Salzer, April, 503.
Infants' chests, Table for use in radiography of, H. Geissberger, Jan., 96.
Intervertebral cartilage, Displacement of, as cause of back pain and sciatica (ab.), E. F. Fincher and E. B. Walker, March, 366.
Intestinal obstruction (ab.), F. Christopher, Jan., 117.
Intestinal obstruction, Acute (ab.), B. H. Nichols, Jan., 118.
Intrathoracic lesions, Density of central shadow in diagnosis of, L. G. Rigler, March, 316.
Intussusception in infancy and childhood (ab.), G. P. Grigsby and S. E. Kaplan, Jan., 117.
Invagination of pylorus into duodenum, Unusual case of (ab.), L. Galifi, Feb., 255.
Joint changes in hemophilia, N. B. Newcomer, May, 573.
Joints, Technic of air injection of (ab.), R. Meyer-Wildisen, Feb., 260.
Knee, Roentgen image of joint space at (ab.), R. Lohr and W. Hellpap, April, 511.
Laryngocele (ab.), W. L. Simpson, May, 632.
Larynx, New applications of planigraphy to physiology and pathology of (ab.), Canuyt, Gunsett, and Greiner, May, 637.
Larynx, Radiography of, anterior view, and technic (ab.), R. Ledoux-Lebard, J. Garcia-Calderon, and A. Djian, May, 632.
Left auricular dilatation in auricular fibrillation, Significance of (ab.), M. L. Sussman and M. T. Woodruff, March, 373.
Ligamentum flavum as factor in production of low back and sciatic pain, Hypertrophy of (ab.), W. D. Abbott, March, 366.
Lipoid pneumonia in infants and children, R. S. Bromer and I. J. Wolman, Jan., 1.
Lipoma of colon nine years after resection of carcinoma of colon, Large pedunculated, O. C. Julian, April, 479.
Liver abscess, Pyogenic (ab.), E. L. Eliason, R. B. Brown, and D. P. Anderson, April, 511.
Low back and sciatic pain, Intractable, due to protruded intervertebral disks; diagnosis and treatment (ab.), J. G. Love, June, 748.
Low back pain in relation to urology (ab.), S. F. Wildman, June, 748.
Lower back, Orthopedic aspects of pain in (ab.), L. W. Breck, Feb., 249.
Lower jaw of Senegalese, Puffy and cystic appearance of (ab.), Castay, Feb., 249.
Luetic osteitis simulating malignant disease (ab.), A. H. Ungerman, W. H. Vicary, and W. W. Eldridge, April, 517.
Lumbosacral anomalies as cause of low backache (ab.), W. Clarkson and A. Barker, June, 748.
Lung abscess due to esophageal overflow (ab.), D. A. Sampson, May, 634.
Lung, Acute aerobic (non-putrid) abscess of (ab.), H. Neuhoff and A. S. W. Touroff, April, 512.
Lungs and bones, Stratigraphy of (ab.), Delaborde, June, 746.
"Lung, Azotemic": radiographic study (ab.), C. Roubier, May, 634.
Lung cysts, Congenital: air expansile types (ab.), W. W. Anderson, May, 634.
Lung embolism, Roentgen diagnosis of (ab.), N. Westermark, May, 634.
Lungs in agricultural workers, Occupational diseases of (ab.), R. Fawcitt, April, 512.
Lung, Primary carcinoma of: clinical study of 160 cases in five years (ab.), A. Arkin, March, 379.
Lungs, Radiographic studies of excretion of dusts from (ab.), A. E. Barclay, K. J. Franklin, and R. G. Macbeth, May, 635.
Lung segments, Division of, in right upper lobe (ab.), E. Behr and E. Huizinga, May, 635.
Lungs, Significance of calcifications within (ab.), D. A. Rhinehart, March, 380.
Lung, Tuberculous ulcerations of, and pulmonary cavities (ab.), B. Faccini, May, 634.
Luxations of shoulder, Undiagnosed (ab.), E. Henrard, April, 516.
Mammography by contrast media, Limitations and dangers of (ab.), S. A. Romano and E. M. McFetridge, April, 504.
Mammography, Studies in evaluation of (ab.), R. A. Reis and S. D. Mesirow, April, 504.
Mandible in Senegalese, Diffuse cystic enlargement of (ab.), Castay, April, 502.
Mastoiditis, Acute (ab.), J. G. Parsons, May, 635.
Measurements, Differences between radiological and anatomical (ab.), C. Wegelius, Jan., 123.
Meningiomas: from roentgenological viewpoint (ab.), C. W. Schwartz, March, 389.
Miniature photographs from roentgen screen, Standing and prospects of (ab.), H. Holfelder and F. Berner, June, 746.
Multiple ulcers of stomach and duodenum (ab.), P. Savy, M. Girard, and Z. Khayat, Jan., 121.
Myocardial damage, Concurrence of radiologic signs and electrocardiographic changes in (ab.), F. Barth, May, 631.
Myosarcoma of stomach: report of two cases, L. G. Allen and P. E. Hiebert, May, 567.
Nephrolithiasis, Late results in conservative management of (ab.), J. T. Priestley and W. F. Braasch, March, 377.
Normal breast, Roentgenologic examination of: evaluation in demonstrating early neoplastic changes (ab.), J. Gershon-Cohen and A. Strickler, March, 368.
Normal first metatarso-phalangeal joint due to changes in direction of central ray, Variations in x-ray appearance of (ab.), B. S. Holmgren, April, 505.
Noses, One hundred broken (ab.), J. W. Gerrie, March, 380.
Obstetrics, Practical employment of radiographic diagnosis in (ab.), P. Brault and A. Tizon, April, 508.
Optic canal, Simple procedure for radiography of (ab.), A. Bardy, Feb., 248.
Osseous-cartilaginous growth, Rare disturbances of (ab.), F. Holldack, March, 366.
Osseous dystrophy of von Recklinghausen type (ab.), M. Deluen, March, 367.
Osteogenesis imperfecta tarda, J. F. Lutz and L. C. Pusch, April, 391.
Osteoma of maxillary sinus (ab.), A. G. Rawlins, March, 384.
Osteomyelitis of spine, Acute infective (ab.), P. Turner, Jan., 124.
Osteoperiostitis associated with hypertrophy of palpebral tarsi, skin of face and extremities, Radiologic aspects of almost total: new syndrome (ab.), J. N. Roy and A. Jutras, April, 502.
Osteoporosis in hyperthyroidism (ab.), E. C. Bartels and G. E. Haggart, Feb., 249.
Pancreas, Characteristic duodenal deformity in cases of different kinds of peri-vaterial enlargement of (ab.), N. Frostberg, March, 381.
Pancreas, Roentgen diagnosis of diseases of (ab.), R. Pohl, March, 381.
Papilloma of kidney pelvis, Roentgenologic demonstration of (ab.), H. Keilhack, March, 377.
Paranasal sinuses, Value of roentgen examination of, V. C. Johnson, March, 303.
Parotid duct, Radiography of, L. W. Paul, May, 609.
Pelvimetry and fetalometry, Roentgenographic: elimination of errors due to movements between x-ray exposures, W. W. Fray and W. T. Pommerenke, March, 261.
Pelvimetry, Roentgen-ray (ab.), C. T. Hayden, Jan., 120.
Pelvimetry, X-ray (ab.), A. Orley, Jan., 120.
Peptic ulcer of esophagus (ab.), J. Terracol, P. Lamarque, and P. Bétoulières, Jan., 121.
Perirenal insufflation (ab.), W. H. Mencher, Jan., 121.
Perisellar tumors, X-ray aspect of (ab.), T. Blühbaum and M. Spritzer, May, 648.
Petrous tip suppuration: report of three cases. Some observations on (ab.), D. E. S. Wishart, Feb., 256.
Placenta previa, Roentgenologic diagnosis of: indirect placentography (ab.), W. H. Ude, J. A. Urner, and F. O. Robbins, June, 749.
Planigraphic image formation, Fundamental property of, (ab.), R. H. De Waard, May, 637.
Planigraphy—application to thoracic diagnosis, W. E. Howes, May, 556.
Planigraphy with mathematical instruments, Computation of dimensions in, D. H. Drummond and W. W. Schmela, May, 550.
Pneumonias, Chronic (ab.), J. G. Scadding, May, 637.
Pneumonia, Resolving lobar, in adults simulating tuberculosis in roentgenogram (ab.), S. Cohen, March, 382.
Pneumothorax, Diagnostic, S. Schnur, Feb., 198.
Pneumothorax in children, Artificial (ab.), P. F. Fitzpatrick, April, 513.
Polycythemia, Course of (ab.), N. Rosenthal and F. A. Bassen, April, 502.
Pregnancy, Plea for more frequent use of lateral roentgenogram in diagnosis of, M. J. Hubeny and P. J. Delano, May, 546.
Prostate, Case of large opacity in (ab.), F. Bernasconi, C. Viallet, R. Marchioni, April, 513.
Pulmonary artery: roentgenographic and roentgen kymographic study, S. Brown, J. E. McCarthy, and A. Fine, Feb., 175.
Pulmonary "biotomes" taken with apparatus of Bocage, Presentation of several (ab.), Léon-Kindberg and L. Gérard, Feb., 247.
Pulmonary chondroma, So-called (ab.), N. P. G. Edling, March, 388.
Pulmonary cysts and emphysematous bullæ, Pathological physiology of (ab.), N. L. Kaltreider and W. W. Fray, May, 633.
Pulmonary cyst with formation of separated peripheral shadows, Rapid evolution of (ab.), Brun, J. De Beaujeu, and Bège, April, 512.
Pulmonary pneumocyst: report of enormous solitary cyst in healthy adult female (ab.), G. Cheney and L. H. Garland, March, 378.
Pulmonary radiography, Diagnostic value of, in primary

ROENTGEN RAYS, examination—*Continued*
tuberculous angina: insufficiency of radioscopy (ab.), L. Weigel, May, 633.
Pulmonary sulcus tumor simulating subacromial bursitis, Superior (ab.), L. Nathanson, L. A. Hochberg, and R. Perlman, March, 388.
Pulmonary suppuration, Non-putrid (ab.), M. L. Sussman, May, 633.
Pulmonary tuberculosis, Roentgenography of (ab.), H. E. Potter, April, 518.
Pulmonary tuberculosis, Spontaneous cure of some forms of (ab.), O. Maestri, April, 519.
Pylorus, Pedunculated cancer of (ab.), Poirier and Lamoureaux, April, 520.
Radiograms and anatomical sections of temporal bone, Comparative study of (ab.), C. G. Zachrisson, Jan., 123.
Radiographic teaching models, Two (ab.), W. E. Boyd, June, 746.
Radiographic visualization of "true joint fissure," Conditions responsible for (ab.), W. Magnusson, Feb., 260.
Radiography after injection of pitressin, Several cases of: experimental proofs (ab.), P. C. Smyrniotis, Jan., 122.
Radiography of heart, Cross-sectional, G. Danelius, Feb., 190.
Radiological disappearance of cavities immediately following phrenico-exeresis and their re-appearance after variable lapse of time (ab.), V. Basunti, April, 518.
Renal carcinoma: study of 95 cases with follow-up notes on 36 (ab.), T. R. Fetter, April, 509.
Renal tuberculosis, Has excretory urography replaced retrograde pyelography in diagnosis of? (ab.), J. L. Emmett and W. F. Braasch, Jan., 128.
Respiratory efficiency, Tests of, and their correlation with radiological appearances in lungs (ab.), E. M. Killick, April, 511.
Retrograde catheterization in diagnosis and treatment of seminal vesiculitis (ab.), A. P. Peterson, Jan., 124.
Retroperitoneal cyst with agenesia of kidney, K. Kornblum and J. A. Ritter, April, 416.
Right quadrant, Problems presented by lesions of (ab.), O. C. Pickhardt and H. A. Rafsky, March, 376.
Sacro-iliac tuberculosis (ab.), F. Thompson, March, 387.
Sarcoma in peri-myocardium, Primary (ab.), P. Cossio and I. Berconsky, May, 631.
Schmorl's cartilage islands (ab.), K. Overgaard, Jan., 125.
Schüller-Christian's disease (ab.), M. Esser, May, 643.
Schüller-Christian's disease (ab.), M. Schieber, May, 643.
Sella turcica, Value of x-ray examination of, in sagittal positions, P. L. Farifias, April, 411.
Septic patient with otitis media, Management of (ab.), J. H. Maxwell, Jan., 120.
Shoulder joint in profile, New position for radiologic examination of (ab.), J. Massa, April, 516.
Sialography in non-neoplastic diseases of parotid gland, Application of, J. V. Blady and A. F. Hocker, Feb., 131.
Silicosis and carcinoma of lung, Association of (ab.), M. O. Klotz, May, 634.
Silicosis, Factors which determine diagnosis of (ab.), C. L. Sutherland, May, 643.
Silicosis in pottery workers (ab.), R. A. K. Harper, April, 516.
Sinus infections, Roentgen therapy of carefully selected, F. M. Hodges and L. O. Snead, June, 669.
Sinus tracts, Simple apparatus for visualization of, L. Long, June, 733.
Spondylitis, Roentgen diagnosis of tuberculous (ab.), N. Westermark and G. Forssman, May, 644.
Spontaneous rib fracture among tuberculous, Radiological study of (ab.), C. Sabbione, Jan., 127.
Stomach, Double ulcer of: radiographs and specimen (ab.), V. Paschetta, May, 636.
Stomach, Hematemesis and diaphragmatic hernia of (ab.), P. Carnot and A. Lafitte, March, 386.
Stomach, Volvulus of (ab.), P. Chêne and M. Ramadout, Jan., 125.
Stratigraphy, Practical pulmonary (ab.), C. Gaillard, June, 747.
Syphilis of bones and joints (ab.), F. A. Jostes and M. B. Roche, May, 645.
Teratomas and dermoid cysts (ab.), W. Kuzma, May, 646.
Thalassanemia (ab.), E. S. Mills, May, 646.
Thymus shadow, in 2,000 new-born, Study of relations between birth weight and size of (ab.), S. W. Donaldson, Jan., 126.
Tibia vara, Adolescent, J. A. Siegling and J. B. Gillespie, April, 483.
Tube rail for general diagnostic x-ray laboratory, Ceiling-mounted, C. J. Zintheo, April, 477.
Tuberculosis, Diagnosis and management of latent, suspected, and early clinical (ab.), H. W. Hetherington, April, 518.
Tuberculous bronchogenic disseminations, Necessity for repeated roentgen investigation in late manifestations of (ab.), H. Bartsch and S. Zollner, March, 379.
Tuberculous pneumonia (ab.), J. W. Strayer, March, 382.
Tumors, Bony intracranial (ab.), C. Pilcher, May, 647.
Tumor, Giant-cell ("osteoclastoma"), of femur treated with x-rays (ab.), S. Dechambre, E. Dechambre, and J. Nebout, May, 648.
Tumors of duodenum and jejunum, Primary, and lymphogranuloma of duodenum (ab.), M. Cace, April, 519.
Tumors of upper pole of stomach (ab.), B. Stenström, Jan., 129.
"Ulcer, large duodenal," Radiologic characteristics of so-called (ab.), D. S. Bartstra, May, 636.
Ureteric calculus, Radiological aspect of treatment of (ab.), D. G. Maitland, March, 368.
Ureters, Two cases of cystic dilatation of lower thirds of left (ab.), E. Herskowits, April, 507.
Urinary calculus, Brief review of 426 consecutive cases of (ab.), H. P. Winsbury-White, Feb., 251.
Venography in case of so-called traumatic thrombosis of axillary vein (ab.), O. Andersson, Jan., 130.
Vertebral articular apophyses, Anomalies of (ab.), F. Willemin and M. Cantagrill, April, 517.
Vertebral column, Changes in, following tetanus (ab.), E. Feistmann-Lutterbeck, May, 645.
Vertebral disease, Case of, difficult to diagnose, in retrospect (ab.), C. Roederer and Choffat, May, 644.
Volvulus of sigmoid megacolon, Roentgenological diagnosis of, with report of two cases, M. R. Hall (ab.), Jan., 117.
X-ray in general practice, Value of (ab.), C. G. Sutherland, May, 646.

measurement
Greinacher "spark" counter for measurement of very small quantities of roentgen and radium rays (ab.), A. Leichti, Feb., 248.

therapy
Acute and chronic inflammatory conditions, Treatment of, by fractional doses of x-ray, H. A. Osgood, March, 311.
Acute osteoporosis, Roentgen therapy in (ab.), E. B. Mumford, March, 367.
Apparatus for roentgen deep therapy, Modern high milliamperage and high voltage (ab.), W. Fehr, June, 746.
Back-scatter, Study of (ab.), E. H. Quimby, L. D. Marinelli, and J. H. Farrow, March, 371.
Benign giant-cell tumor of bone, Roentgen diagnosis and treatment of (ab.), J. A. Meadows and K. F. Kesmodel, March, 367.
Breast, Treatment of carcinoma of: technic, complications, and results, E. Newcomer, Feb., 161.
Bronchiectasis, Further experience with roentgen therapy for, M. Berck and W. Harris, June, 693.
Calcified scrotal tumor, A. Fine and S. Brown, Jan., 92.
Cancer campaign: suggestions for better treatment of malignant growths (ab.), A. M. Begg, Feb., 253.
Cancer of cervix: therapeutic and biological thoughts (ab.), S. Laborde, April, 520.
Cancer of lung, Primary (ab.), D. S. King, April, 511.
Carcinoma, Development of treatment methods for uterine, at Women's Clinic of University of Würzburg (ab.), T. C. Neeff, May, 649.
Carcinoma of breast treated by teleroentgentherapy, Vertebral metastasis from (ab.), A. Poulain, Feb., 250.
Carcinoma of cervix and breast: prognosis and preferable therapy (ab.), E. D. Greenberger, March, 370.
Carcinoma of cervix, Radium therapy of (ab.), K. Wasserburger and H. Smereker, Jan., 122.
Carcinoma of cervix, Results in treatment of, at Women's Clinic of University of Göttingen from 1926 to 1937 (ab.), F. Erichsen, April, 520.
Carcinoma of cervix, Treatment of, in Women's Clinic of University of Königsberg from 1910 to 1937 (ab.), F. v. Mikulicz-Radecki, March, 390.
Carcinoma of cervix uteri, Treatment of (ab.), R. E. Myers, March, 369.
Carcinoma of esophagus, Studies regarding technic and methods in radiation therapy of (ab.), A. Adam, Feb., 257.
Carcinoma of hypopharynx, Results of radiation therapy in (ab.), E. Bandhauer, Feb., 252.
Carcinoma of larynx and hypopharynx, Results of roentgen and radium therapy in (ab.), R. Müller, April, 503.
Carcinoma of prostate, Metastases from occult (ab.), O. S. Culp, April, 513.
Carcinoma of skin and lip, Early results of near distance radiation in (ab.), A. Hrabovszky, Feb., 254.
Carcinoma of thymus, with marked pulmonary osteoarthropathy, E. R. Miller, June, 651.
Carcinoma of uterine cervix (ab.), H. H. Bowing and R. E. Fricke, May, 649.
Carcinoma of uterus, Avoidance of injurious effects on bladder in radiation therapy of (ab.), T. C. Neeff and F. Hoff, June, 749.
Carcinoma of uterus, Thirty years' experience in treatment of (ab.), A. Mayer, March, 390.
Carcinoma, Present method of radiation therapy of uterine, in first gynecological clinic of University of Munich (ab.), F. G. Dietel, May, 650.
Carcinoma, Radium therapy of bladder: five-year results, failures, and future therapy (ab.), B. S. Barringer, May, 641.
Carotid sinus syndrome, Use of roentgen therapy in, C. A. Stevenson, Feb., 209.
Cervix carcinoma, Early results in, from single and divided doses of roentgen radiation (ab.), A. N. Arneson, March, 371.
Cervix uteri, Factors relating to treatment of (ab.), G. H. Johnson, March, 390.
Chaoul, Roentgen therapy by method of, E. P. Pendergrass, P. J. Hodes, and C. J. Garrahan, Feb., 142.
Chauffard-Still's disease, Treatment of (ab.), F. LePennetier, March, 385.

Chorionepithelioma testis, with record of case, Observations on (ab.), S. McDonald, Jr., March, 388.
Collum carcinoma, Results obtained in radiation treatment of inoperable (ab.), I. de Büben, March, 370.
Curved surfaces, Technic of roentgen therapy of (ab.), A. Proppe, March, 384.
Cystadenoma in double kidney, Malignant papillary (ab.), N. F. Ockerblad and H. E. Carlson, April, 510.
Dermatology, Skin therapy in (ab.), C. Guarini, May, 644.
Dosage in radiation therapy in simple terms, Value of assessing and prescribing, R. Paterson, Feb., 221.
Dosage measurements by simple computations, H. M. Parker, May, 591.
Dosage units and ionization method (ab.), R. M. Sievert, March, 372.
Effect of change of environments of animal cells on their radiosensitivity, Experimental study on (ab.), Y. Kagami, April, 501.
Embryoma of kidney (Wilms' tumor), ab., W. E. Ladd, April, 510.
Epilepsy, Experience with roentgen therapy in (ab.), M. Sgalitzer, April, 505.
Epilepsy, Roentgen therapy of (ab.), W. von Weiser, April, 505.
Erysipeloid, X-ray treatment of (ab.), M. A. Walker and L. G. Allen, May, 644.
Ewing's tumor, Radiosensitivity of (ab.), G.-C. Leclerc, May, 648.
Experimental production of sarcoma with radium and mesothorium (ab.), E. Uehlinger and O. Schürch, March, 383.
Fibroids, Pretended responsibility of roentgen therapy for sarcomatous degeneration of irradiated (ab.), G. Daniel, May, 650.
Fungus infections, Radiation therapy of (ab.), D. Spangler, March, 375.
Gas gangrene infections, Treatment of (ab.), J. J. Faust, April, 506.
Granulomas, Treatment of malignant, by radiotherapy (ab.), R. Gilbert, May, 648.
Granulomatosis, Radiculo-medullary compression in course of malignant (ab.), J. Froment, P. Croizat, and R. Masson, Jan., 125.
Gynecological radium therapy, Development of, especially in treatment of non-malignant disease (ab.), C. J. Gauss, May, 642.
Hemangioma which was clinically cured by radiotherapy, Compression of vertebra by (ab.), G. de Luca, May, 644.
Hemorrhagic disorders, Roentgen treatment of certain (ab.), L. H. Garland, March, 385.
Hemorrhagic metritis cured by roentgen irradiation of hypophysis, Case of (ab.), J. Moro and Monmignaut, April 507.
Hyperthyroidism, Treatment of, with consideration of other of ductless glands as trigger mechanism: based upon observation of 360 cases, I. W. Jenkins, March, 340.
Infections, Radiation therapy of (ab.), H. G. Reineke, March, 376.
Inflammatory conditions, Dosage and method of roentgen therapy for, A. U. Desjardins, June, 699.
Inflammatory conditions, Fundamental principles of roentgen therapy of (ab.), W. von Weiser, Feb., 259.
Inflammatory diseases, Roentgen treatment of (ab.), G. Clement, May, 632.
Injury of blood in consequence of teleroentgen therapy of whole body, Serious (ab.), D. den Hoed, B. Levie, and M. Straub, March, 386.
Leukemia, Roentgen treatment of, with report of pregnancy in case of lymphatic leukemia, E. K. Harrison and R. J. Reeves, March, 284.
Lobar pneumonia, Roentgen therapy of (ab.), E. V. Powell, March, 382.
Low voltage radiation, Some experiences, experimental and clinical, with direct irradiation of neurological tumors during operation with, J. R. Carty and B. S. Ray, March, 325.
Lower back, Orthopedic aspect of pain in (ab.), L. W. Breck, Feb., 249.
Lymphoblastoma, Irradiation of cutaneous manifestations of (ab.), R. G. Pett, April, 520.
Lymphocytoma, Progress of case of (ab.), Brillouet and A. Viel, March, 389.
Melanoma, Case of (ab.), M. Arnaud, April, 520.
Malignant cells, Further study on direct and indirect actions of radiation on: I.—Transplantation of tissue cultures of Mouse Sarcoma 180 after exposure to roentgen rays: II.—Cultures of tumors irradiated *in vivo*, K. Sugiura and I. Cohen, Jan., 71.
Malignant lesions, Occurrence of two or more primary, J. J. Collins, April, 462.
Malignant tumors, Surgical standpoint regarding radiation therapy of (ab.), F. Sauerbruch, in collaboration with K. Middeldorpf, March, 389.
Mastitis and breast cancer, Chronic: family history of five sisters (ab.), S. W. Hadley, Feb., 250.
Measurement of tissue dosage in radiation therapy, E. H. Quimby, May, 583.
Meningiomas: from roentgenological viewpoint (ab.), C. W. Schwartz, March, 389.
Menstrual dysfunctions and sterility, Roentgen treatment of: analysis of 108 cases, S. Bruck and J. M. Fruchter, April, 446.
Metrorrhagia cured by radiotherapy: subsequent pregnancy (ab.), Dano and Lainé, April, 507.
Myoma uteri, Treatment of (ab.), T. B. Lee, May, 650.
Operable cancer of breast, Technic of x-ray treatment of, based upon analysis of Keynes' radium technic, J. R. Andrews, March, 294.
Osseous dystrophy of von Recklinghausen type (ab.), M. Deluen, March, 367.
Oto-rhino-laryngological cancer by radiations, Indications and results of treatment of (ab.), L. Eloy, Feb., 253.
Otitis media, acute, Evaluation of roentgen irradiation as adjunct in treatment of: preliminary report, A. H. Dowdy, C. A. Heatly, and W. W. Pierce, June, 661.
Ovarian irradiation, Recovery following human, H. W. Jacox, May, 538.
Paget's disease of bone, Roentgen therapy in (ab.), R. Ledoux-Lebard, March, 367.
Perirenal fibrosarcoma (ab.), H. H. Howard and H. I. Suby, March, 377.
Peritonitis, acute, and other infections, Roentgen treatment of, with mobile x-ray apparatus, J. F. Kelly and D. A. Dowell, June, 675.
Physical measurements on roentgen radiation from tube actuated by Van de Graaf generator, J. C. Hudson, May, 530.
Plantar wart (ab.), W. Kelton, April, 520.
Plantar warts, Treatment of: clinical memorandum (ab.), H. Haldin-Davis, April, 520.
Potential in deep therapy, Problem of (ab.), L. Graf and J. Graf, Jan., 122.
Primary neoplasms of lung, Radiation therapy in (ab.), R. E. Myers, March, 379.
Pulmonary tuberculosis, Direct roentgen therapy through small fields of (ab.), G. Faldella, April, 518.
Radiation therapy and glands of internal secretion (ed.), March, 360.
Radiobiology and radiation therapy (ab.), A. Gunsett, April, 514.
Radiosensitivity and recurrent growth in *Obelia*, P. S. Henshaw, April, 466.
Radiotherapy, Scope of (ab.), H. H. Navid, March, 384.
Recovery from roentgen rays, Influence of low temperature on, E. V. Cook, March, 289.
Renal carcinoma: study of 95 cases with follow-up notes on 36 (ab.), T. R. Fetter, April, 509.
Renal tumors: review of 130 cases (ab.), H. A. Soloway, March, 388.
Results of irradiation with soft roentgen rays at very small focus-skin distance (contact therapy), ab., D. den Hoed, May, 644.
Reticulo-endothelial tissue with small doses of roentgen rays, Studies on irradiation of (ab.), S. A. Chrom, April, 501.
Roentgen caustic (ab.), G. J. van der Plaats, March, 371.
Roentgen epilation, E. Aronstein, Jan., 95.
Roentgen therapy (ab.), L. S. McAlister, Feb., 253.
"Rotation" irradiation, Determination of dose in (ab.), R. du Mesnil de Rochemont, March, 372.
Sarcoma of prostate and adjacent retrovesical structures (ab.), E. Hess, April, 513.
Sarcoma, Results of treatment of osteogenic (ab.), H. W. Meyerding, March, 388.
Schüller-Christian's disease (ab.), M. Schieber, May, 643.
Sinus infections, Roentgen therapy of carefully selected, F. M. Hodges and L. O. Snead, June, 669.
Sinusitis, Roentgen therapy of (ab.), L. Popp, March, 385.
Skin malignancy, Treatment of, by irradiation (ab.), H. W. Jacox, March, 369.
Superficial radiotherapy: contact radiotherapy (Chaoul) (ab.), W. Gassmann, May, 639.
Supervoltage (ed.), A. Soiland, June, 742.
Thimble ionization chamber, Note on use of clinical dosage meters using, M. C. Reinhard, March, 282.
Thymus shadow in 2,000 new-born, Study of relations between birth weight and size of (ab.), S. W. Donaldson, Jan., 126.
Tonsillitis, Roentgen therapy of chronic (ab.), P. Heb, March, 386.
Tracheal stenosis from roentgen therapy (ab.), L. H. Clerf and F. J. Putney, April, 514.
Tumor, Giant-cell ("osteoclastoma"), of femur treated with x-rays (ab.), S. Dechambre, E. Dechambre, and J. Nebout, May, 648.
Tumor of bone, Giant-cell (ab.), B. L. Coley and N. L. Higinbotham, March, 367.
Tumors of larynx (ab.), F. A. Figi, May, 632.
Tumors, Renal (ab.), J. C. McClelland and J. R. F. Mills, March, 389.
Uterine cavity, Involution of, after irradiation of fibromas (ab.), Guilbert, Tortat, Frain, and Le Guern, May, 649.
Uterine hemorrhage, Radiotherapy in non-malignant (ab.), B. Windeyer, May, 631.
Waldeyer's ring in children, Roentgen therapy of diseases of (ab.), H. Weissig, March, 387.

terms

Language of engineers and radiologists: new x-ray terms proposed: rhegma, rhothion, kludon, plem, aith, R. R. Newell, March, 270.

tubes

Discharge x-ray tube, Experiments with condenser (ab.), K. H. Kingdon and H. E. Tanis, Jr., Feb., 247.
Near-distance x-ray tubes and body cavity tubes of various

ROENTGEN RAYS, tubes—*Continued*
constructions, Distribution of dose in (ab.), T. Zimmer, June, 747.
Radiation output of shock-proof x-ray tubes, Effect of cable length on, T. H. Rogers, Feb., 202.
Shock-proof and ray-proof containers for roentgen therapy tubes, Five years' experience of modern (ab.), R. Thoraeus, Feb., 247.
Siemens body cavity x-ray tube with pointed anode, New (ab.), Zimmer, Feb., 247.
Tube actuated by Van de Graaf generator, Physical measurements on roentgen radiation from, J. C. Hudson, May, 530.

SACRO-ILIAC JOINT
Anomalies, Lumbosacral, as cause of low backache (ab.), W. Clarkson and A. Barker, June, 748.
Tuberculosis, Sacro-iliac (ab.), F. Thompson, March, 387.
SALIVARY GLANDS
Sialography in non-neoplastic diseases of parotid gland, Application of, J. V. Blady and A. F. Hocker, Feb., 131.
SARCOMA
Experimental production of sarcoma with radium and mesothorium (ab.), E. Uehlinger and O. Schürch, March, 383.
Malignant cells, Further study on direct and indirect actions of radiation on: I.—Transplantation of tissue cultures of Mouse Sarcoma 180 after exposure to roentgen rays: II.—Cultures of tumors irradiated *in vivo*, K. Sugiura and I. Cohen, Jan., 71.
Osteogenic sarcoma, Results of treatment of (ab.), H. W. Meyerding, March, 388.
Primary sarcoma in peri-myocardium (ab.), P. Cossio and I. Berconsky, May, 631.
Prostate, Sarcoma of, and adjacent retrovesical structures (ab.), E. Hess, April, 513.
Radiation therapy in sarcomas, Results of (ab.), O. Walther, May, 642.
Soluble radium, injected into animal, distributed in various body tissue, How is? (ab.), F. Daels, March, 383.
Voluminous osteogenic sarcoma of left coxofemoral region (ab.), Carteret, Dillenseger, and P. Bertrand, May, 643.
fibrosarcoma
Perirenal fibrosarcoma (ab.), H. H. Howard and H. I. Suby, March, 377.
melanosarcoma
Melanosarcoma, Three-year cure of case of (ab.), Drevon and Mourgues, March, 389.
myosarcoma
Myosarcoma of stomach; report of two cases, L. G. Allen and P. E. Hiebert, May, 567.
SCAPULA
Calcification of bursa of coracoclavicular ligament (ab.), H. J. McCurrich, April, 503.
Fracture of neck of scapula (ab.), M. R. Charlton, Feb., 258.
SCHÜLLER-CHRISTIAN SYNDROME
Schüller-Christian's disease (ab.), M. Esser, May, 643.
Schüller-Christian's disease (ab.), M. Schieber, May, 643.
SCROTUM
Calcified scrotal tumor, A. Fine and S. Brown, Jan., 92.
SEMILUNAR CARTILAGE
Calcification of meniscus and hypertrophic spurring (ab.), Roederer, Gaucher, and Jésover, April, 517.
SEMINAL VESICLES
Retrograde catheterization in diagnosis and treatment of seminal vesiculitis (ab.), A. P. Peterson, Jan., 124.
SHOULDER
Arthritis of shoulder, Chronic (ab.), J. G. Kuhns, Feb., 248.
Luxations of shoulder, Undiagnosed (ab.), E. Henrard, April, 516.
Radiologic examination of shoulder joint in profile, New position for (ab.), J. Massa, April, 516.
SILICOSIS
Carcinoma of lung, Association of silicosis and (ab.), M. O. Klotz, May, 634.
Diagnosis of silicosis, Factors which determine (ab.), C. L. Sutherland, May, 643.
Dusts from lungs, Roentgenologic studies of excretion of (ab.), A. E. Barclay, K. J. Franklin, and R. G. Macbeth, March, 384.
Silicosis, Study of (ab.), P. B. Matz, March, 384.
Silicosis in grinders (ab.), J. L. A. Grout, April, 516.
Silicosis in pottery industry (ab.), J. F. Bromley, April, 516.
Silicosis in pottery workers (ab.), R. A. K. Harper, April, 516.
SINUSES
Visualization of sinus tracts, Simple apparatus for, L. Long, June, 733.
cavernous
Aneurysms of internal carotid artery in cavernous sinus, Saccular (ab.), G. Jefferson, April, 508.
nasal
Diseases of accessory nasal sinuses by roentgen study, Diagnosis (ab.), L. Stehr, March, 385.
Paranasal sinuses, Value of roentgen examination of, V. C. Johnson, March, 303.
Pneumatization of facial bones in Crouzon's disease, Apert's disease, and oxycephaly (ab.), P. de Gunten, March, 384.
Roentgen therapy of carefully selected sinus infections, F. M. Hodges and L. O. Snead, June, 669.
Sinusitis, Roentgen therapy of (ab.), L. Popp, March, 385.

SKIN
Carcinoma of skin and lip, Early results of near distance radiation in (ab.), A. Hrabovszky, Feb., 254.
Carcinoma of skin and lip, Radium therapy of (ab.), J. Körbler, March, 383.
Irradiation of cutaneous manifestations of lymphoblastoma (ab.), R. G. Pett, April, 520.
Radiodermatitis and active ulceration, Several cases of, treated and cured by halibut liver ointment (ab.), Belot, Nahan, and Marquis, April, 514.
Roentgen injury, Report of acute (ab.), K. Hoede, April, 514.
Roentgen late injuries (ab.), F. John, April, 515.
Skin malignancy by irradiation, Treatment of (ab.), H. W. Jacox, March, 369.
diseases
Erysipeloid, X-ray treatment of (ab.), M. A. Walker and L. G. Allen, May, 644.
Irradiation, Results of, with soft roentgen rays at very small focus-skin distance (contact therapy), ab., D. den Hoed, May, 644.
Roentgen therapy in dermatology (ab.), C. Guarini, May, 644.
SKULL
Head injury, Unusual (ab.), C. K. Fuller, March, 385.
Sella turcica, Value of x-ray examination of, in sagittal positions, P. L. Fariñas, April, 411.
tuberculosis in
Bone tuberculosis, Unusual manifestations of, B. P. Widmann, H. W. Ostrum, and R. F. Miller, April, 434 (436).
SOCIALIZED MEDICINE
Socialized medicine, Economic status of radiologist under: report on Germany, S. W. Donaldson, March, 351.
Socialized medicine, Economic status of radiologist under: report on England, S. W. Donaldson, April, 486.
SOCIETIES
American Association of Industrial Physicians and Surgeons, April, 493.
American Board of Radiology, Jan., 113.
American Congress on Obstetrics and Gynecology, Feb., 238.
American Medical Association, June, 736, 738.
American Society of X-ray Technicians, June, 743.
Associated Radiologists of New York, Inc., Jan., 103; Feb., 233; March, 358; April, 489; May, 615; June, 740.
Baltimore City Medical Society, Radiological Sect., Jan., 102; Feb., 232; March, 357; April, 488; May, 614; June, 739.
Brooklyn Roentgen Ray Society, Jan., 103; Feb., 233; March, 358; April, 489; May, 615; June, 740.
Buffalo Radiological Society, Jan., 103; Feb., 233; March, 358; April, 489; May, 615; June, 740.
California Medical Association, Sect. on Radiology, Jan., 102; Feb., 232; March, 357; April, 488; May, 614; June, 739.
Canadian Association of Radiologists, Jan., 114.
Central New York Roentgen-ray Society, Jan., 103; Feb., 233; March, 358; April, 489; May, 615; June, 740.
Chicago Roentgen Society, Jan., 102; Feb., 232; March, 357; April, 488; May, 614; June, 739.
Cleveland Radiological Society, Jan., 104; Feb., 234; March, 359; April, 490; May, 616; June, 741.
Connecticut State Medical Society, Sect. on Radiology, Jan., 102; Feb., 232; March, 357; April, 488; May, 614; June, 739.
Denver Radiological Club, Jan., 102; Feb., 229, 232; March, 357; April, 488; May, 614; June, 739.
Detroit X-ray and Radium Society, Jan., 102; Feb., 232; March, 357; April, 488; May, 614; June, 739.
Faculty of Radiologists, April, 492.
Florida Medical Society, Feb., 330.
Florida Radiological Society, Jan., 102, 113; Feb., 232; March, 357; April, 488; May, 614; June, 737, 739.
Georgia Radiological Society, Jan., 102; Feb., 232; March, 357; April, 488; May, 614, 622; June, 737, 739.
Illinois Radiological Society, Jan., 102; Feb., 232; March, 357; April, 488; May, 614; June, 739.
Illinois State Medical Society, Sect. on Radiology, Jan., 102; Feb., 229, 232; March, 357; April, 488; May, 614; June, 739.
Indiana Roentgen Society, Jan., 102; Feb., 230, 232; March, 357; April, 488; May, 614; June, 739.
Iowa State Medical Society, June, 737.
Iowa X-ray Club, Jan., 102; Feb., 230, 232; March, 357; April, 488; May, 614; June, 739.
Kansas City Radiological Society, Jan., 103; Feb., 233; March, 358; April, 489; May, 615; June, 740.
Long Island Radiological Society, Jan., 103; Feb., 233; March, 358; April, 489; May, 615; June, 740.
Los Angeles County Medical Association, Radiological Sect., Jan., 102; Feb., 232; March, 357; April, 488; May, 614; June, 739.
Medical Society of West Virginia. *See* West Virginia State Medical Association.
Memphis Roentgen Club, Jan., 104; Feb., 234; March, 359; April, 490; May, 616; June, 741.
Michigan Association of Roentgenologists, Jan., 103; Feb., 233; March, 358; April, 489; May, 615; June, 740.
Michigan State Medical Society, Feb., 228; June, 736.
Milwaukee Roentgen Ray Society, Jan., 104; Feb., 234; March, 359; April, 490; May, 616; June, 741.

Minnesota Radiological Society, Jan., 103; Feb., 233; March, 358; April, 489; May, 615, 622; June, 740.
Multnomah County (Oregon) Medical Society, Feb., 229.
Nebraska Radiological Society, Jan., 103; Feb., 233, 229; March, 358; April, 489; May, 615; June, 740.
New England Roentgen Ray Society, Jan., 103; Feb., 233; March, 358; April, 489; May, 615; June, 740.
New York Academy of Medicine, Twelfth Graduate Fortnight of, May, 621.
New York Roentgen Society, Jan., 103; Feb., 233; March, 358; April, 489; May, 615; June, 740.
North Carolina Medical Society, Feb., 228.
Oregon State Medical Society, Feb., 229.
Pacific Roentgen Club, Jan., 102; Feb., 228, 232; March, 357; April, 488; May, 614; June, 739.
Pennsylvania Radiological Society, Jan., 104; Feb., 234; March, 359; April, 490; May, 616; June, 741.
Philadelphia County Medical Society, Fourth annual postgraduate institute, Jan., 113.
Philadelphia Roentgen Ray Society, Jan., 104; Feb., 234; March, 359; April, 490; May, 616; June, 741.
Pittsburgh Roentgen Society, Jan., 104; Feb., 234; March, 359; April, 490; May, 616; June, 741.
Radiological Sect. of Wisconsin State Medical Society, Jan., 104; Feb., 234; March, 359; April, 490; May, 616; June, 741.
Radiological Society of Academy of Medicine (Cincinnati Roentgenologists), Jan., 104; Feb., 234; March, 359; April, 490; May, 616; June, 741.
Radiological Society of New Jersey, Jan., 103; Feb., 233; March, 358; April, 489; May, 615; June, 740.
Radiological Society of North America. *See under* **Radiological.**
Radiological Society of North Carolina, Jan., 103; Feb., 233; March, 358; April, 489; May, 615; June, 740.
Radiological Society of Virginia, Jan., 104; Feb., 234; March, 359; April, 490; May, 616; June, 741.
Rochester Roentgen-ray Society, Jan., 103; Feb., 233; March, 358; April, 489; May, 615; June, 740.
St. Louis Society of Radiologists, Jan., 103; Feb., 233; March, 358; April, 489; May, 615; June, 740.
San Francisco Radiological Society, Jan., 102; Feb., 232; March, 357; April, 488; May, 614; June, 739.
South Carolina X-ray Society, Jan., 104; Feb., 234; March, 359; April, 490; May, 616; June, 741.
Tennessee State Radiological Society, Jan., 104; Feb., 234; March, 359; April, 490; May, 616; June, 741.
Texas Radiological Society, Jan., 104; Feb., 229, 234; March, 359; April, 490; May, 616; June, 741.
University of Wisconsin Radiological Conference, Jan., 104; Feb., 234; March, 359; April, 490; May, 616; June, 741.
Washington State Radiological Society, Jan., 104; Feb., 234; March, 359; April, 490; May 616; June, 741.
West Virginia State Medical Association, Feb., 228.
See **Inter-Society Committee for Radiology,** in Author Index.

SPINAL CORD
Neurological tumors, Some experiences, experimental and clinical, with direct irradiation of, during operation with low voltage radiation, J. R. Carty and B. S. Ray, March, 325.
Radiculo-medullary compression in course of malignant granulomatosis (ab.), J. Froment, P. Croizat, and R. Masson, Jan., 125.

SPINE
Anomalies of spine (ab.), W. Bailey and R. A. Carter, Jan., 125.
Anomalies of vertebral articular apophyses (ab.), F. Willemin and M. Cantagrill, April, 517.
Calcification of meniscus and hypertrophic spurring (ab.), Roederer, Gaucher, and Jésover, April, 517.
Cancer, Remarks on vertebral (ab.), F.-G. Marill, R. Raynaud, and A. Huguenin, April, 517.
Cervical spine, Three cases of injury to, including one of unrecognized fracture of odontoid (ab.) Brillouet and A. Viel, March, 372.
Changes in vertebral column following tetanus (ab.), E. Feistmann-Lutterbeck, May, 645.
Cranial and spinal lesions in epileptic: difficulties of interpretation (ab.), R. Raynaud, A. Huguenin, and H. Tillier, April, 505.
Echinococcus of spine, Case of, difficult to interpret roentgenologically (ab.), C. Guidotti, May, 645.
Hemangioma, Compression of vertebra by, which was clinically cured by radiotherapy (ab.), G. de Luca, May, 644.
Hemangioma of vertebræ, Radiation therapy of primary (ab.), I. H. Lockwood and C. E. Bell, May, 644.
Hodgkin's disease of bones (ab.), H. S. Lieberman, March, 367.
Intervertebral cartilage, Displacement of, as cause of back pain and sciatica (ab.), E. F. Fincher and E. B. Walker, March, 366.
Low back and sciatic pain, Hypertrophy of ligamentum flavum as factor in production of (ab.), W. D. Abbott, March, 366.
Low back and sciatic pain, intractable due to protruded intervertebral disks: diagnosis and treatment (ab.), J. G. Love, June, 748.
Lower back, Orthopedic aspect of pain in (ab.), L. W. Breck, Feb., 249.
Osteo-arthritis due to *Brucella melitensis*, Vertebral (ab.), H. Duclos, April, 517.
Osteomyelitis of spine, Acute infective (ab.), P. Turner, Jan., 124.
Paraplegia from erosion of vertebral column by large thoracic aneurysm, M. J. Hubeny and P. J. Delano, Feb., 171.
Pathologic conditions of spine: painful disturbances of intervertebral foramina (ab.), L. A. Hadley, Jan., 124.
Roentgen late injuries (ab.), F. John, April, 515.
Schmorl's cartilage islands (ab.), K. Overgaard, Jan., 125.
Tuberculous spondylitis, Roentgen diagnosis of (ab.), N. Westermark and G. Forssman, May, 644.
Vertebral disease, case of, difficult to diagnose, in retrospect (ab.), C. Roederer and Choffat, May, 644.
Vertebral metastasis from carcinoma of breast treated by teleroentgentherapy (ab.), A. Poulain, Feb., 250.
tuberculosis in
Bone tuberculosis, Unusual manifestations of, B. P. Widmann, H. W. Ostrum, and R. F. Miller, April, 434 (435).

SPLEEN
Chauffard-Still's disease, treatment of (ab.), F. LePennetier, March, 385.
Hemorrhagic disorders, roentgen treatment of certain (ab.), L. H. Garland, March, 385.

STERILITY
Sterility, Roentgen treatment of menstrual dysfunctions and: analysis of 108 cases, S. Bruck and J. M. Fruchter, April, 446.

STOMACH
Cancer of stomach, Early diagnosis of (ab.), L. J. Notkin, June, 752.
Cancer of stomach, Symptoms, diagnosis, and treatment of (ab.), J. S. Horsley, March, 385.
Cancer, Two cases of gastric: difficulty of radio-diagnosis of lesions of pyloric antrum (ab.), P. Vasselle, March, 369.
Cancer, X-ray diagnosis of gastric (ab.), A. J. Delario, June, 752.
Cardiac end of stomach simulating soft tissue tumefaction in supine position, Shadow of, L. Nathanson, April, 473.
Cardiospasm: report of case, M. Golob, April, 481.
Evacuation of stomach, Influence of pituitrin on (ab.), R. I. Levina, Jan., 126.
Fibroma of stomach, True (ab.), C. B. Udaondo, E. Finochietto, and D. Mosto, May, 647.
Gastric and duodenal ulcers, Limitations of internal medical treatment of (ab.), H. Müller, March, 381.
Gastric lesion produced by posterior pituitary extract (ab.), M. H. Metz, Jan., 125.
Gastroscopic studies (ab.), E. H. Gaither and J. L. Borland, Jan., 126.
Hematemesis and diaphragmatic hernia of stomach (ab.), P. Carnot and A. Lafitte, March, 386.
Hyperthyroidism and hypothyroidism on gastric evacuation, Influence of (ab.), R. I. Levina, March, 386.
Images of antrum, Inorganic lacunar (ab.), P. Porcher, March, 386.
Multiple ulcers of stomach and duodenum (ab.), P. Savy, M. Girard, and Z. Khayat, Jan., 121.
Myosarcoma of stomach: report of two cases, L. G. Allen and P. E. Hiebert, May, 567.
Tumors of upper pole of stomach (ab.), B. Stenström, Jan., 129.
Ulcer of stomach, Double: radiographs and specimen (ab.), V. Paschetta, May, 636.
inflammation
Roentgenologic consideration of gastritis, M. Feldman, June, 726.
volvulus
Stomach, Volvulus of (ab.), P. Chêne and M. Ramadout Jan., 125.

STRATIGRAPHY
Lungs and bones, Stratigraphy of (ab.), Delaborde, June, 746.
Pulmonary stratigraphy, Practical (ab.), C. Gaillard, June, 747.

SURGERY
Carcinoma of breast, Value of radiation in treatment of, L. G. Allen, Jan., 63.

SYPHILIS
Bones and joints, Syphilis of (ab.), F. A. Jostes and M. B. Roche, May, 645.
Bone syphilis, Roentgenological manifestations in (ab.), D. M. Stewart, April, 518.
Gastric syphilis, pseudo-neoplastic type: clinical and radiologic study (ab.), H. Marc and Sire, May, 645.
Gastric syphilis, Two cases of (ab.), P. A. Blinkenberg, May, 645.
Osteitis simulating malignant disease, Luetic (ab.), A. H. Ungerman, W. H. Vicary, and W. W. Eldridge, April, 517.

TEETH
Focal (dental) infection, Diagnosis of, especially by means of roentgenogram (ab.), W. Praeger, Feb., 255.

TELEROENTGEN THERAPY
Injury of blood in consequence of teleroentgen therapy of whole body, Serious (ab.), D. den Hoed, B. Levie, and M. Straub, March, 386.

TEMPERATURE
Influence of low temperature on recovery from roentgen rays, E. V. Cook, March, 289.
TEMPORAL BONE
Radiograms and anatomical sections of temporal bone, Comparative study of (ab.), C.-G. Zachrisson, Jan., 123.
Petrous tip suppuration: report of three cases, Some observations on (ab.), D. E. S. Wishart, Feb., 256.
TESTIS
Chorionepithelioma testis, with record of case, Observations on (ab.), S. McDonald, Jr., March, 388.
TETANUS
Vertebral column, Changes in, following tetanus (ab.), E. Feistmann-Lutterbeck, May, 645.
THORAX
Adipose tissue, Roentgen diagnostic importance of, J. Silbermann, Jan., 77 (82).
Aneurysm, Paraplegia from erosion of vertebral column by large thoracic, M. J. Hubeny and P. J. Delano, Feb., 171.
Intrathoracic lesions, Density of central shadow in diagnosis of, L. G. Rigler, March, 316.
Planigraphy—its application to thoracic diagnosis, W. E. Howes, May, 556.
Pulmonary "biotmes" taken with apparatus of Bocage, Presentation of several (ab.), Léon-Kindberg and L. Gérard, Feb., 247.
Radiography of heart, Cross-sectional, G. Danelius, Feb., 190 (191).
THORIUM DIOXIDE
Lymphatics (ed.), April, 491.
THROMBOSIS, axillary
Venography in case of so-called traumatic thrombosis of axillary vein (ab.), O. Andersson, Jan., 130.
venous
Carcinoma and venous thrombosis: frequency of association of carcinoma in body or tail of pancreas with multiple venous thrombosis (ab.), E. E. Sproul, June, 752.
THYMUS
Carcinoma of thymus, with marked pulmonary osteoarthropathy, E. R. Miller, June, 651.
Thymus shadow in 2,000 new-born, Study of relations between birth weight and size of (ab.), S. W. Donaldson, Jan., 126.
THYROID
Goiter, Relief of anginoid pain following removal of intrathoracic non-toxic nodular (ab.), J. Edeiken and E. Rose, Feb., 259.
Hyperthyroidism and hypothyroidism on gastric evacuation, Influence of (ab.), R. I. Levina, March, 386.
Hyperthyroidism, Treatment of, with consideration of other of ductless glands as trigger mechanism: based upon observation of 360 cases, I. W. Jenkins, March, 340.
Osteoporosis in hyperthyroidism (ab.), E. C. Bartels and G. E. Haggart, Feb., 249.
TIBIA
Adolescent tibia vara, J. A. Siegling and J. B. Gillespie, April, 483.
TONGUE, inflammation
Glossitis, Median rhomboid, J. F. Sammet, Feb., 215.
TONSILS
Papilloma of tonsil, with report of three cases (ab.), I. Frank, March, 387.
Tonsillitis, Roentgen therapy of chronic, (ab.), P. Heb, March, 386.
Waldeyer's ring in children, Roentgen therapy of diseases of (ab.), H. Weissig, March, 387.
TRACHEA
Tracheal stenosis from roentgen therapy (ab.), L. H. Clerf and F. J. Putney, April, 514.
TUBERCULOSIS
Chest, Skiagraphy of (ab.), G. Jessel, Jan., 119.
Silicosis, Factors which determine diagnosis of (ab.), C. L. Sutherland, May, 643.
Silicosis, Study of (ab.), P. B. Matz, March, 384.
Spondylitis, Roentgen diagnosis of tuberculous (ab.), N. Westermark and G. Forssman, May, 644.
Ulcerations of lung, Tuberculous, and pulmonary cavities (ab.), B. Faccini, May, 634.
of intestines
Tuberculosis of intestines in tuberculous anthracosilicosis (ab.), R. Charr and A. C. Cohen, Jan., 126.
osteo-arthritic
Bone tuberculosis, Unusual manifestations of, B. P. Widmann, H. W. Ostrum, and R. F. Miller, April, 434.
pulmonary
Adipose tissue, Roentgen diagnostic importance of, J. Silbermann, Jan., 77 (83).
Barium enemas to disclose latent intestinal tuberculosis in cases with pulmonary tuberculosis, Necessity of systematic use of (ab.), M. Picard, Jan., 128.
Calcifications within lungs, Significance of (ab.), D. A. Rhinehart, March, 380.
Childhood tuberculosis, Certain significant aspects of (ab.), R. M. Tyson, Jan., 127.
Contralateral spontaneous pneumothorax complicating artificial pneumothorax, (ab.), J. B. Andosca, April, 513.
Cure of some forms of pulmonary tuberculosis, Spontaneous (ab.), O. Maestri, April, 519.
Diagnosis and management of latent, suspected, and early clinical tuberculosis (ab.), H. W. Hetherington, April, 518.
Pneumonia, Resolving lobar, in adults simulating tuberculosis in roentgenogram (ab.), S. Cohen, March, 382.
Pneumothorax in children, Artificial (ab.), P. F. Fitzpatrick, April, 513.
Pulmonary [valve] in fibrothorax, Relative insufficiency of (ab.), N. Cavarozzi, Jan., 119.
Radiography in primary tuberculous angina, Diagnostic value of: insufficiency of radioscopy (ab.), L. Weigel, May, 633.
Radiological disappearance of cavities immediately following phrenico-exeresis and their re-appearance after variable lapse of time (ab.), V. Basunti, April, 518.
Roentgen therapy through small fields of pulmonary tuberculosis, Direct (ab.), G. Faldella, April, 518.
Roentgenography of pulmonary tuberculosis (ab.), H. E. Potter, April, 518.
Spontaneous rib fracture among tuberculous, Radiological study of (ab.), C. Sabbione, Jan., 127.
Thoracic diagnosis, Planigraphy—its application to, W. E. Howes, May, 556 (559).
Tuberculin, Correlation of positive reaction to, and shape of chest (ab.), S. A. Weisman, April, 519.
Tuberculous bronchogenic dissemination, Necessity for repeated roentgen investigation in late manifestations of (ab.), H. Bartsch and S. Zollner, March, 379.
Tuberculous lesions, Effect of unilateral pneumothorax on pre-existing, in opposite lung (study of 200 cases), ab., U. de Michelis and E. Conte, April, 513.
Tuberculous pneumonia (ab.), J. W. Strayer, March, 382.
renal
Renal tuberculosis (ab.), C. D. Donahue, May, 646.
Renal tuberculosis, Has excretory urography replaced retrograde pyelography in diagnosis of? (ab.), J. L. Emmett and W. F. Braasch, Jan., 128.
surgical
Sacro-iliac tuberculosis (ab.), F. Thompson, March, 387.
TUMORS
Benign giant-cell tumor of bone, Roentgen diagnosis and treatment of (ab.), J. A. Meadows and K. F. Kesmodel, March, 367.
Bladder tumors, Radiological diagnosis of (ab.), W. Sitkowski, June, 749.
Bone tumors (ab.), C. A. Hellwig and C. H. Warfield, March, 368.
Bone tumors (ab.), G. J. McChesney, R. L. Carroll, and K. S. Davis, March, 368.
Bony intracranial tumors (ab.), C. Pilcher, May, 647.
Calcified scrotal tumor, A. Fine and S. Brown, Jan., 92.
Cancer of lung, Primary (ab.), D. S. King, April, 511.
Carcinoma of lung, Roentgenographic images in primary, L. A. Hochberg, June, 713.
Carcinoma of prostate, Metastases from occult (ab.), O. S. Culp, April, 513.
Colospasms, Causes and results (ab.), L. Gleize-Rambal, Feb., 255.
Cystic hygroma of neck (ab.), B. L. Flemming, Jan., 129.
Duodenum and jejunum, Primary tumors of, and lymphogranuloma of duodenum (ab.), M. Cace, April, 519.
Fibroma of stomach, True (ab.), C. B. Udaondo, E. Finochietto, and D. Mosto, May, 647.
Giant-cell tumor of bone (ab.), B. L. Coley and N. L. Higinbotham, March, 367.
Giant-cell tumor ("osteoclastoma") of femur treated with x-rays (ab.), S. Dechambre, E. Dechambre, and J. Nebout, May, 648.
Histological tumor variants and their influence upon radiosensitivity, Some, I. A. B. Cathie, April, 425.
Larynx, Tumors of (ab.), F. A. Figi, May, 632.
Lymphoblastoma, Irradiation of cutaneous manifestations of (ab.), R. G. Pett, April, 520.
Malignant tumors of uterus, Multiple heteromorphologic, H. W. Jacox, G. Major, and M. R. Baker, Jan., 51.
Malignant tumors, Surgical standpoint regarding radiation therapy of (ab.), F. Sauerbruch, in collaboration with K. Middeldorpf, March, 389.
Mammography by contrast media, Limitations and dangers of (ab.), S. A. Romano and E. M. McFetridge, April, 504.
Mediastinal tumors, Roentgen kymographic studies of aneurysms and (ab.), W. G. Scott and S. Moore, March, 377.
Mixed tumors of hard palate (ab.), F. T. Hill, March, 389.
Myoma uteri, Treatment of (ab.), T. B. Lee, May, 650.
Myosarcoma of stomach: report of two cases, L. G. Allen and P. E. Hiebert, May, 567.
Neurological tumors, Some experiences, experimental and clinical, with direct irradiation of, during operation with low voltage radiation, J. R. Carty and B. S. Ray, March, 325.
Ovarian irradiation, Recovery following human, H. W. Jacox, May, 538 (541).
Perisellar tumors, X-ray aspect of (ab.), T. Blühbaum and M. Spritzer, May, 648.
Primary malignant lesions, Occurrence of two or more, J. J. Collins, April, 462.
Primary sarcoma in peri-myocardium (ab.), P. Cossio and I. Berconsky, May, 631.
Pylorus, Pedunculated cancer of (ab.), Poirier and Lamoureaux, April, 520.

Radiation therapy of sarcomas, Results of (ab.), O. Walther, May, 642.
Radiosensitivity of Ewing's tumor (ab.), G.-C. Leclerc, May, 648.
Renal carcinoma: study of 95 cases with follow-up notes on 36 (ab.), T. R. Fetter, April, 509.
Renal tumors (ab.), J. C. McClelland and J. R. F. Mills, March, 389.
Renal tumors: review of 130 cases (ab.), H. A. Soloway, March, 388.
Roentgen therapy, Pretended responsibility of, for sarcomatous degeneration of irradiated fibroids (ab.), G. Daniel, May, 650.
Stomach, On tumors of upper pole of (ab.), B. Stenström, Jan., 129.
Sulcus tumor simulating subacromial bursitis, Superior pulmonary (ab.), L. Nathanson, L. A. Hochberg, and R. Perlman, March, 388.
Teratomas and dermoid cysts (ab.), W. Kuzma, May, 646.
Thoracic diagnosis, Planigraphy—its application to, W. E. Howes, May, 556 (563, 566).
Tumors, Classification of (ab.), L. A. Pomeroy, Jan., 129.
Uterine fibroids, Use of radium in treatment of (ab.), L. Feid, Jr., Jan., 122.

adamantinoma
Adamantinoma of tibia (ab.), B. Wolfort and D. Sloane, March, 389.

adenoma
Malignant papillary cystadenoma in double kidney (ab.), N. F. Ockerblad and H. E. Carlson, April, 510.

angioma
Angiomas, Calcification in (ab.), F. Y. Khoo, Jan., 128.
Hemangioma, Compression of vertebra by, which was clinically cured by radiotherapy (ab.), G. de Luca, May, 644.
Hemangioma involving bones of extremities, Primary (ab.), C. F. Geschickter and I. H. Maseritz, Feb., 250.
Hemangioma of vertebræ, Radiation therapy of primary (ab.), I. H. Lockwood and C. E. Bell, May, 644.
Hemorrhoids and ano-rectal angiomas in infants (ab.), A. Bensaude and F. Bertillon, Jan., 123.
Radium therapy of hemangiomas (ab.), W. Baensch, April, 515.
Roentgen therapy by method of Chaoul, E. P. Pendergrass, P. J. Hodes, and C. J. Garrahan, Feb., 142 (148).

chondroma
Chondroma, So-called pulmonary (ab.), N. P. G. Edling, March, 388.

chordoma
Chordoma, with report of two cases (ab.), R. F. Ridpath, March, 387.

chorionepithelioma
Chorionepithelioma in male (ab.), E. J. Knoflicek, March, 388.
Chorionepithelioma testis, with record of case, Observations on (ab.), S. McDonald, Jr., March, 388.

embryoma
Embryoma of kidney (Wilms' tumor), ab., W. E. Ladd, April, 510.

fibroma
Irradiation of fibromas, Involution of uterine cavity after (ab.), Guilbert, Tortat, Frain, and Le Guern, May, 649.
Uterine fibroids, Use of radium in treatment of (ab.), L. Feid, Jr., Jan., 122.

leiomyoma
Leiomyoma of oral cavity (ab.), A. P. Stout, March, 387.

lipoma
Adipose tissue, Roentgen diagnostic importance of, J. Silbermann, Jan., 77.
Pedunculated lipoma of colon nine years after resection of carcinoma of colon, Large, O. C. Julian, April, 479.

lymphocytoma
Lymphocytoma, Progress of case of (ab.), Brillouet and A. Viel, March, 389.

melanoma
Melanoma, Case of (ab.), M. Arnaud, April, 520.
Tumor variants and their influence upon radiosensitivity, Some histological, I. A. B. Cathie, April, 425 (432).

meningioma. *See* **Meninges, tumors.**

osteoma
Osteoma of maxillary sinus (ab.), A. G. Rawlins, March, 384.

papilloma
Papilloma of kidney pelvis, Roentgenologic demonstration of (ab.), H. Keilhack, March, 377.
Tonsil, Papilloma of, with report of three cases (ab.), I. Frank, March, 387.

sarcoid
Sarcoidosis: report of case (ab.), W. B. Blanton, March, 367.

TYPHOID, complications and sequelæ
Typhoid empyema: report of case operated upon and cured (ab.), A. C. Neto and J. Finocchiaro, Jan., 119.

ULTRA-VIOLET LIGHT
Body weight, Influence of ultra-violet rays on, F. Ellinger, Feb., 157.
Erysipelas with ultra-violet energy, Treatment of, M. E. Knapp, Feb., 195.
Mitogenetic radiation, Present status of, A. Hollaender, April, 404.
Ultra-violet therapy: several new sources of radiation, their mechanism of action and clinical indications (ab.), E. Biancani and H. Biancani, Jan., 130.
Vitamin C content of milk, Effect of ultra-violet rays on (ab.), H. Schroeder, Jan., 130.

URETERS
Dilatation of lower thirds of left ureters, Two cases of cystic (ab.), E. Herskowits, April, 507.
Dilatations of upper urinary tract in children, Non-obstructive (ab.), A. B. Hepler, April, 507.

UROGRAPHY
"Excretory urography by intramuscular injection of diodrast," Authors' note on, H. B. Hunt and A. M. Popma, Jan., 113.
Heminephrectomy in disease of double kidney (ab.), E. Beer and W. H. Mencher, April, 509.
Renal tuberculosis, Has excretory urography replaced retrograde pyelography in diagnosis of? (ab.), J. L. Emmett and W. F. Braasch, Jan., 128.
Urinary calculus, Brief review of 426 consecutive cases of (ab.), H. P. Winsbury-White, Feb., 251.

UROLOGY
Urology, Low back pain in relation to (ab.), S. F. Wildman, June, 748.

UTERUS
Cancer of cervix: therapeutic and biological thoughts (ab.), S. Laborde, April, 520.
Carcinoma, Development of treatment methods for uterine, at Woman's Clinic of University of Würzburg (ab.), T. C. Neeff, May, 649.
Carcinoma of cervix and breast: prognosis and preferable therapy (ab.), E. D. Greenberger, March, 370.
Carcinoma of cervix, Radium therapy of (ab.), K. Wasserburger and H. Smereker, Jan., 122.
Carcinoma of cervix, Results and experiences in treatment of, with special consideration of radium therapy (ab.), P. Caffier, May, 649.
Carcinoma of cervix, Results in treatment of, at Women's Clinic of University of Göttingen from 1926 to 1937 (ab.), F. Erichsen, April, 520.
Carcinoma of cervix, Treatment of, in Women's Clinic of University of Königsberg from 1910 to 1937 (ab.), F. v. Mikulicz-Radecki, March, 390.
Carcinoma of cervix uteri, Treatment of (ab.), R. E. Myers, March, 369.
Carcinoma of uterine cervix (ab.), H. H. Bowing and R. E. Fricke, May, 649.
Carcinoma of uterus, Avoidance of injurious effects on bladder in radiation therapy of (ab.), T. C. Neeff and F. Hoff, June, 749.
Carcinoma of uterus, Is it possible to use radium bomb for intravaginal treatment of, and would it be possible to improve considerably distribution of radiation? (ab.), R. du Mesnil de Rochemont, April, 515.
Carcinoma of uterus, Thirty years' experience in treatment of (ab.), A. Mayer, March, 390.
Carcinoma, Present method of radiation therapy of uterine, in first gynecological clinic of University of Munich (ab.), F. G. Dietel, May, 650.
Cervix carcinoma, Early results in, from single and divided doses of roentgen radiation (ab.), A. N. Arneson, March, 371.
Cervix uteri, Factors relating to treatment of (ab.), G. H. Johnson, March, 390.
Collum carcinoma, Results obtained in radiation treatment of inoperable (ab.), I. de Büben, March, 370.
Fibroids, Pretended responsibility of roentgen therapy for sarcomatous degeneration of irradiated (ab.), G. Daniel, May, 650.
Fibromas, Involution of uterine cavity after irradiation of (ab.), Guilbert, Tortat, Frain, and Le Guern, May, 649.
Hemorrhagic metritis cured by roentgen irradiation of hypophysis, Case of (ab.), J. Moro and Monmignaut, April, 507.
Malignant tumors of uterus, Multiple heteromorphologic, H. W. Jacox, G. Major, and M. R. Baker, Jan., 51.
Myoma uteri, Treatment of (ab.), T. B. Lee, May, 650.
Placenta previa, Roentgenologic diagnosis: indirect placentography (ab.), W. H. Ude, J. A. Urner, and F. O. Robbins, June, 749.
Radiotherapy in non-malignant uterine hemorrhage (ab.), B. Windeyer, May, 631.
Radium therapy of hemorrhagic metropathies, Intra-uterine (ab.), A. Pickhan, May, 641.
Uterine fibroids, Use of radium in treatment of (ab.), L. Feid, Jr., Jan., 122.

hemorrhage
Metrorrhagia cured by radiotherapy: subsequent pregnancy (ab.), Dano and Lainé, April, 507.

VEINS
Axillary vein, Venography in case of so-called traumatic thrombosis of (ab.), O. Andersson, Jan., 130.
X-ray inquiry into genesis of current of venous blood and lymph, K. Mayer, March, 275.

VERRUCA
Plantar wart (ab.), W. Kelton, April, 520.
Plantar warts, Treatment of: clinical memorandum (ab.), H. Haldin-Davis, April, 520.

vulgaris
Roentgen therapy by method of Chaoul, E. P. Pendergrass, P. J. Hodes, and C. J. Garrahan, Feb., 142 (148).

VERTEBRÆ. *See* **Spine.**
VITAMINS
Leukopenia, Therapy of x-ray (ab.), C. Carrié, April, 515.
Vitamin C content of milk, Effect of ultra-violet rays on (ab.), H. Schroeder, Jan., 130.
Vitamin D in chronic arthritis, Massive doses of: effect on calcium metabolism (ab.), C. L. Steinberg, March, 366.

WARTS. *See* **Verruca**
WRIST
Os centrale of wrist (ab.), R. O. Tanguy, March, 390.
Traumatic axial rotation by gear movement of carpal scaphoid and trapezium with subluxation and foreshortening of first metacarpal (ab.), A. A. Schmier and M. S. Burman, March, 390.

AUTHORS

ABBOTT, WALTER D. (ab.), Hypertrophy of ligamentum flavum as factor in production of low back and sciatic pain, March, 366.
ADAM, A. (ab.), Studies regarding technic and methods in radiation therapy of carcinoma of esophagus, Feb., 257.
ÅKERLUND, ÅKE (ab.), Formation of transparent gas-filled fissures in gallstones, and their significance for radiological diagnosis, June, 751.
ALDRICH, C. A., and ANSPACH, W. E., Rupture of esophagus from blow on abdomen, Jan., 93.
ALLEN, LEWIS G., Value of radiation in treatment of carcinoma of breast, Jan., 63.
ALLEN, LEWIS G., and HIEBERT, P. E., Myosarcoma of stomach: report of two cases, May, 567.
ALLEN, LEWIS G., *with* **WALKER, MAURICE A.,** jt. auth.
ANDERSON, DAVID P., *with* **ELIASON, ELDRIDGE L.,** jt. auth.
ANDERSON, WILLIAM WILLIS (ab.), Congenital lung cysts: air expansile types, May, 634.
ANDERSSON, OLOF (ab.), Venography in case of so-called traumatic thrombosis of axillary vein, Jan., 130.
ANDOSCA, JOHN B. (ab.), Contralateral spontaneous pneumothorax complicating artificial pneumothorax, April, 513.
ANDREWS, J. ROBERT, Technic of x-ray treatment of operable cancer of breast based upon analysis of Keynes' radium technic, March, 294.
ANSPACH, W. E., *with* **ALDRICH, C. A.,** jt. auth.
ARKIN, AARON (ab.), Primary carcinoma of lung: clinical study of 160 cases in five years, March, 379.
ARNAUD, M. (ab.), Case of melanoma, April, 520.
ARNESON, A. N. (ab.), Early results in cervix carcinoma from single and divided doses of roentgen radiation, March, 371.
ARONSTEIN, ERNST, Roentgen epilation, Jan., 95.

BAENSCH, W. (ab.), Radium therapy of hemangiomas, April, 515.
BAILEY, WILBUR, and CARTER, RAY A. (ab.), Anomalies of spine, Jan., 125.
BAILEY, WILBUR, and KNOLL, WILLIAM V., Gastrocolic fistula, March, 346.
BAKER, MARGARET R., *with* **JACOX, HAROLD W.,** jt. auth.
BANDHAUER, E. (ab.), Results of radiation therapy in carcinoma of hypopharynx, Feb., 252.
BARCLAY, A. E., FRANKLIN, K. J., and MACBETH, R. G. (ab.), Radiographic studies of excretion of dusts from lungs, May, 635.
Idem (ab.), Roentgenographic studies of excretion of dusts from lungs, March, 384.
BARDY, A. (ab.), Simple procedure for radiography of optic canal, Feb., 248.
BARKER, ALLEN, *with* **CLARKSON, WRIGHT,** jt. auth.
BARRINGER, BENJAMIN S. (ab.), Radium therapy of bladder carcinoma: five-year results, failures, and future therapy, May, 641.
BARTELS, ELMER C., and HAGGART, GILBERT E. (ab.), Osteoporosis in hyperthyroidism, Feb., 249.
BARTH, FRIEDERIKE (ab.), Concurrence of radiologic signs and electrocardiographic changes in myocardial damage, May, 631.
BARTSCH, H., and ZOLLNER, S. (ab.), Necessity for repeated roentgen investigation in late manifestions of tuberculous bronchogenic dissemination, March, 379.
BARTSTRA, D. S. (ab.), Radiologic characteristics of so-called "large duodenal ulcer," May, 636.
BASSEN, FRANK A., *with* **ROSENTHAL, NATHAN,** jt. auth.
BASUNTI, V. (ab.), Radiological disappearance of cavities immediately following phrenico-exeresis and their re-appearance after variable lapse of time, April, 518.
DE BEAUJEU, JAUBERT, *with* **BRUN,** jt. auth.
BEER, EDWIN, and MENCHER, WILLIAM H. (ab.), Hemi-nephrectomy in disease of double kidney, April, 509.
BÈGE *with* **BRUN,** jt. auth.
BEGG, A. M. (ab.), Cancer campaign: suggestions for better treatment of malignant growths, Feb., 253.
BEHR, E., and HUIZINGA, EELCO (ab.), Division of lung segments in right upper lobe, May, 635.
BELL, CHARLES E., *with* **LOCKWOOD, IRA H.,** jt. auth.
BELL, JOSEPH C., Further consideration of roentgen-ray manifestations in amebic infections of large bowel, March, 332.
BELOT, NAHAN, and MARQUIS (ab.), Several cases of radiodermatitis and active ulceration treated and cured by halibut liver ointment, April 514.
BENSAUDE, ALFRED, and BERTILLON, F. (ab.), Hemorrhoids and ano-rectal angiomas in infants, Jan., 123.
BERCK, MAURICE, and HARRIS, WILLIAM, Further experience with roentgen therapy for bronchiectasis, June, 693.
BERCONSKY, I., *with* **COSSIO, P.,** jt. auth.
BERG, ALBERT A., *with* **CROHN, BURRILL B.,** jt. auth.
BERGENDAL, ASTA (ab.), Review of 20 years' radium treatment of lip cancer at Radiological Clinic, Lund, Sweden, Jan., 123.
BERNASCONI, FR., VIALLET, CH., and MARCHIONI, R. (ab.), Case of large opacity in prostate, April, 513.
BERNER, F., *with* **HOLFELDER, H.,** jt. auth.
BERNET, E. J., *with* **PARKINSON, D. B.,** jt. auth.
BERTILLON, F., *with* **BENSAUDE, ALFRED,** jt. auth.
BERTRAND, P., *with* **CARTERET,** jt. auth.
BEST, R. RUSSELL, and HICKEN, N. FREDERICK (ab.), Non-operative management of remaining common duct stones, Feb., 251.
BEST, R. RUSSELL, *with* **HICKEN, N. FREDERICK,** jt. auth.
BETLACH, C. J. (ab.), Effects of pentothal sodium on electrocardiogram of patients with essential hypertension, Jan., 128.
BÉTOULIÈRES, *with* **LAMARQUE,** jt. auth.
BÉTOULIÈRES, PIERRE, *with* **TERRACOL, J.,** jt. auth.
BIANCANI, E., and BIANCANI, H. (ab.), Ultra-violet therapy: several new sources of radiation, their mechanism of action and clinical indications, Jan., 130.
BIANCANI, H., *with* **BIANCANI, E.,** jt. auth.
BIERMAN, WILLIAM, and LEVENSON, CARL L., Fever therapy in gonococcal infections, April, 454.
BINET, E., and DILLENSEGER (ab.), Large calculus of gall bladder with suppuration, Feb., 251.
BISCHOFF, L. (ab.), Instructive case of aneurysm of heart wall with "teeter-movement" symptom, June, 746.
BLADY, JOHN V., and HOCKER, ALFRED F., Application of sialography in non-neoplastic diseases of parotid gland, Feb., 131.
BLANTON, WYNDHAM B. (ab.), Sarcoidosis: report of case, March, 367.
BLINKENBERG, P. A. (ab.), Two cases of gastric syphilis, May, 645.
BLÜHBAUM, TEOFIL, and SPRITZER, MARCELI (ab.), X-ray aspect of perisellar tumors, May, 648.
BOCAGE, M. A. (ab.), Biotome: presentation of apparatus, Feb., 247.
BOCCA, C. (ab.), Mega-esophagus and narrowing of terminal portion of esophagus, Feb., 257.
BODMER, H., *with* **HIRSCHI, H.,** jt. auth.
BOLAND, S. J. (ab.), Radiology of gastro-intestinal tract: value of co-operation, April, 506.
BORLAND, JAMES L., *with* **GAITHER, ERNEST H.,** jt. auth.
BOUWERS, A. (ab.), Technic of neutron production and the production of artificial radio-activity, April, 501.
BOWING, HARRY H., and FRICKE, ROBERT E. (ab.), Carcinoma of uterine cervix, May, 649.
BOYD, W. E. (ab.), Two radiographic teaching models, June, 746.
BRAASCH, WILLIAM F., *with* **EMMETT, JOHN L.,** jt. auth.
BRAASCH, WILLIAM F., *with* **PRIESTLEY, JAMES T.,** jt. auth.
BRAILSFORD, JAMES F. (ab.), Brodie's abscess and differential diagnosis, Feb., 249.
BRAULT, P., and TIZON, A. (ab.), Practical employment of radiographic diagnosis in obstetrics, April, 508.
BRECK, LOUIS W. (ab.), Orthopedic aspects of pain in lower back, Feb., 249.
BRETON, A., *with* **PIERRET,** jt. auth.
BRILLOUET and VIEL, A. (ab.), Progress of case of lymphocytoma, March, 389.
Idem (ab.), Three cases of injury to cervical spine, including one of unrecognized fracture of odontoid, March, 372.
BROMER, RALPH S., and WOLMAN, IRVING J., Lipoid pneumonia in infants and children, Jan., 1.
BROMLEY, J. F. (ab.), Silicosis in pottery industry, April, 516.
BROWN, PHILIP W., and MARCLEY, DAVID M. (ab.), Prognosis of diverticulitis and diverticulosis of colon, Feb., 254.
BROWN, ROBERT B., *with* **ELIASON, ELDRIDGE L.,** jt. auth.
BROWN, SAMUEL, *with* **FINE, ARCHIE,** jt. auth.
BROWN, SAMUEL, McCARTHY, J. E., and FINE, ARCHIE, Pulmonary artery: roentgenographic and roentgen kymographic study, Feb., 175.
BRUCK, SAMUEL, and FRUCHTER, JOSEPH M., Roentgen treatment of menstrual dysfunctions and sterility: analysis of 108 cases, April, 446.
BRUN, De BEAUJEU, JAUBERT, and BÈGE (ab.), Rapid evolution of pulmonary cyst with formation of separated peripheral shadows, April, 512.
de BÜBEN, IVAN (ab.), Results obtained in radiation treatment of inoperable collum carcinoma, March, 370.
BUIE, LOUIS A. (ab.), Melanosis coli, May, 642.

BURFORD, GEORGE E., *with* **JONES, OSWALD R.,** jt. auth.
BURKE, EUGENE M., *with* **MATTICK, WALTER L.,** jt. auth.
BURMAN, MICHAEL S., *with* **SCHMIER, ADOLPH A.,** jt. auth.

CABLE, J. VERNEY (ab.), Late results of surgical treatment in perforated peptic ulcer, March, 381.
CACE, MANLIO (ab.), Primary tumors of duodenum and jejunum and lymphogranuloma of duodenum, April, 519.
CADÉ, A., and MILHAUD, M. (ab.), Cancer of transverse colon of masked type, March, 371.
CAFFIER, P. (ab.), Results and experiences in treatment of carcinoma of cervix, with special consideration of radium therapy, May, 649.
CAHAL, MAC F., General welfare of radiology, Jan., 98; Points of interest, Feb., 228; Who shall practise medicine? May, 611; Points of interest, June, 736.
CAMERON, A. T., WHITE, F. D., and MELTZER, SARA (ab.), Calcium carbonate deposits in human gall bladder, April, 505.
CANTAGRILL, M., *with* **WILLEMIN, F.,** jt. auth.
CANUYT, GUNSETT, and GREINER (ab.), New applications of planigraphy to physiology and pathology of larynx, May, 637.
CARLSON, HJALMAR E., *with* **OCKERBLAD, NELSE F.,** jt. auth.
CARNOT, PAUL, and LAFITTE, ABEL (ab.), Hematemesis and diaphragmatic hernia of stomach, March, 386.
CARRIÉ, C. (ab.), Therapy of x-ray leukopenia, April, 515.
CARROLL, ROBERT L., *with* **McCHESNEY, GEORGE J.,** jt. auth.
CARTER, RAY A., *with* **BAILEY, WILBUR,** jt. auth.
CARTERET, DILLENSEGER, and BERTRAND, P. (ab.), Voluminous osteogenic sarcoma of left coxofemoral region, May, 643.
CARTY, JOHN RUSSELL, and RAY, BRONSON S., Some experiences, experimental and clinical, with direct irradiation of neurological tumors during operation with low voltage radiation, March, 325.
CASTAY (ab.), Diffuse cystic enlargement of mandible in Senegalese, April, 502.
Idem (ab.), Puffy and cystic appearance of lower jaw of Senegalese, Feb., 249.
CATHIE, I. A. B., Some histological tumor variants and their influence upon radiosensitivity, April, 425.
CAVAROZZI, NICOLA (ab.), Relative insufficiency of pulmonary in fibrothorax, Jan., 119.
CHARLTON, MAX R. (ab.), Fracture of neck of scapula, Feb., 258.
CHARR, ROBERT, and COHEN, ARCHIBALD C. (ab.), Tuberculosis of intestines in tuberculous anthracosilicosis, Jan., 126.
CHÊNE, P., and RAMADOUT, M. (ab.), Volvulus of stomach, Jan., 125.
CHENEY, GARNETT, and GARLAND, L. HENRY (ab.), Pulmonary pneumocyst: report of enormous solitary cyst in healthy adult female, March, 378.
CHOFFAT *with* **ROEDERER, C.,** jt. auth.
CHRISTOPHER, FREDERICK (ab.), Intestinal obstruction, Jan., 117.
CHROM, SV. A. (ab.), Studies on irradiation of the reticuloendothelial tissue with small doses of roentgen rays, April, 501.
CLARKSON, WRIGHT, and BARKER, ALLEN (ab.), Lumbosacral anomalies as cause of low backache, June, 748.
CLEMENT, GAGE (ab.), Roentgen treatment of inflammatory diseases, May, 632.
CLERF, LOUIS H., and PUTNEY, F. JOHNSON (ab.), Tracheal stenosis from roentgen therapy, April, 514.
COHEN, ARCHIBALD C., *with* **CHARR, ROBERT,** jt. auth.
COHEN, IRVING, *with* **SUGIURA, KANEMATSU,** jt. auth.
COHEN, SAMUEL (ab.), Resolving lobar pneumonia in adults simulating tuberculosis in roentgenogram, March, 382.
COLE, F. N. (ab.), Delayed resolution in bronchopneumonia, March, 382.
COLEY, BRADLEY L., and HIGINBOTHAM, NORMAN L. (ab.), Giant-cell tumor of bone, March, 367.
COLLEDGE, LIONEL (ab.), Treatment of carcinoma in pharynx and larynx and results, March, 370.
COLLINS, GEORGE B., and REILING, VICTOR G. (ab.), Cerenkov radiation, May, 637.
COLLINS, J. J., Occurrence of two or more primary malignant lesions, April, 462.
CONTE, E., *with* **de MICHELIS, U.,** jt. auth.
COOK, EVELYN VANDERWILT, Influence of low temperature on recovery from roentgen rays, March, 289.
CORREIA NETO, ALIPIO, and FINOCCHIARO, JOSÉ (ab.), Typhoid empyema: report of case operated upon and cured, Jan., 119.
COSSIO, P., and BERCONSKY, I. (ab.), Primary sarcoma in the peri-myocardium, May, 631.
COULOUMA, P., *with* **PIERRET,** jt. auth.
CRANE, NORMAN F., *with* **STEWART, HAROLD J.,** jt. auth.
CROHN, BURRILL B., and BERG, ALBERT A. (ab.), Right-sided (regional) colitis, Jan., 117.
CROIZAT, P., *with* **FROMENT, J.,** jt. auth.
CROWTHER, J. A. (ab.), Biologic effect of roentgen rays, Feb., 249.
CULP, ORMOND S. (ab.), Metastases from occult carcinoma of prostate, April, 513.

DAELS, F., FAJERMAN, H., and VAN HOVE, VAN de PUTTE (ab.), How is soluble radium, injected into animal, distributed in various body tissues? March, 383.
DANELIUS, GERHARD, Cross-sectional radiography of heart, Feb., 190.
DANIEL, GASTON (ab.), Pretended responsibility of roentgen therapy for sarcomatous degeneration of irradiated fibroids, May, 650.
DANO and LAINÉ (ab.), Metrorrhagia cured by radiotherapy: subsequent pregnancy, April, 507.
D'AUNOY, RIGNEY, OGDEN, MICHAEL ALEXANDER, and HALPERT, BÉLA (ab.), Primary carcinoma of biliary system: clinico-pathological analysis of 40 cases, March, 369.
DAVIS, KENNETH S., *with* **McCHESNEY, GEORGE J.,** jt. auth.
DECHAMBRE, E., *with* **DECHAMBRE, S.,** jt. auth.
DECHAMBRE, S., DECHAMBRE, E., and NEBOUT, J. (ab.), Giant-cell tumor ("osteoclastoma") of femur treated with x-rays, May, 648.
DEITRICK, JOHN E., *with* **STEWART, HAROLD J.,** jt. auth.
DELABORDE (ab.), Stratigraphy of lungs and bones, June, 746.
DELANO, PERCY J., *with* **HUBENY, MAXIMILIAN J.,** jt. auth.
DELARIO, A. J. (ab.), X-ray diagnosis of gastric cancer, June, 752.
DELUEN, M. (ab.), Osseous dystrophy of von Recklinghausen type, March, 367.
den HOED, D. (ab.), Results of irradiation with soft roentgen rays at very small focus-skin distance (contact therapy), May, 644.
den HOED, D., LEVIE, B., and STRAUB, M. (ab.), Serious injury of blood in consequence of teleroentgen therapy of whole body, March, 386.
DESJARDINS, ARTHUR U., Antoine Béclère (1856–1939), May, 622.
Idem, Dosage and method of roentgen therapy for inflammatory conditions, June, 699.
DEVOS, L., *with* **PIERRET,** jt. auth.
De WAARD, R. H. (ab.), Fundamental property of planigraphic image formation, May, 637.
DICKSON, ERNEST C., and GIFFORD, MYRNIE A. (ab.), Coccidioides infection (coccidioidomycosis). II. Primary type of infection, April, 509.
DIETEL, F. G. (ab.), Present method of radiation therapy of uterine carcinoma in first gynecological clinic of University of Munich, May, 650.
DILLENSEGER, *with* **BINET, E.,** jt. auth.
DILLENSEGER, *with* **CARTERET,** jt. auth.
DJIAN, ALBERT, *with* **LEDOUX-LEBARD, R.,** jt. auth.
DONAHUE, CHARLES D. (ab.), Renal tuberculosis, May, 646.
DONALDSON, S. W., Economic status of radiologist under socialized medicine: report on Germany, March, 351; Economic status of radiologist under socialized medicine: report on England, April, 486.
Idem (ab.), Study of relations between birth weight and size of thymus shadow in 2,000 new-born, Jan., 126.
DOWDY, ANDREW H., HEATLY, CLYDE A., and PIERCE, WILLIAM W., Evaluation of roentgen irradiation as adjunct in treatment of acute otitis media: preliminary report, June, 661.
DOWELL, D. ARNOLD, *with* **KELLY, JAMES F.,** jt. auth.
DREVON and MOURGUES (ab.), Three-year cure of case of melanosarcoma, March, 389.
DRUMMOND, D. H., and SCHMELA, W. W., Computation of dimensions in planigraphy with mathematical instruments, May, 550.
DUCLOS, H. (ab.), Vertebral osteo-arthritis due to *Brucella melitensis*, April, 517.
DUFFY, JAMES J. (ab.), Cervical lymph nodes in intra-oral carcinoma: surgery or irradiation? March, 370.
DUMONT, G. (ab.), Diverticulum of duodeno-jejunal angle, April, 506.

EDEIKEN, JOSEPH, and ROSE, EDWARD (ab.), Relief of anginoid pain following removal of intrathoracic non-toxic nodular goiter, Feb., 259.
EDLING, NILS P. G. (ab.), So-called pulmonary chondroma, March, 388.
EISEN, DAVID (ab.), Esophageal hiatus hernia, with special reference to x-ray diagnosis, Feb., 257.
ELDRIDGE, W. W., *with* **UNGERMAN, A. H.,** jt. auth.
ELIASON, ELDRIDGE L., BROWN, ROBERT B., and ANDERSON, DAVID P. (ab.), Pyogenic liver abscess, April, 511.
ELLINGER, FRIEDRICH, Influence of ultra-violet rays on body weight, Feb., 157.
ELOY, L. (ab.), Indications and results of treatment of oto-rhino-laryngological cancer by radiations, Feb., 253.
EMMETT, JOHN L., and BRAASCH, WILLIAM F. (ab.), Has excretory urography replaced retrograde pyelography in diagnosis of renal tuberculosis? Jan., 128.
ENGEL, GILSON C., and MAY, HANS (ab.), Two-plane direction and range finder for nailing fractures of neck of femur, Feb., 258.
ERICHSEN, F. (ab.), Results in treatment of carcinoma of cervix at Women's Clinic of University of Göttingen from 1926 to 1937, April, 520.

ESSER, C. H., and OTT, P. (ab.), Problem of "high current" x-ray apparatus, Feb., 248.
ESSER, M. (ab.), Schüller-Christian's disease, May, 643.
EWING, AGNEW R., *with* **FRIEDEWALD, WILLIAM F.,** jt. auth.

FACCINI, BRUNO (ab.), Tuberculous ulcerations of lung and pulmonary cavities, May, 634.
FAIRCLOUGH, W. A., *with* **NEIL, J. HARDIE,** jt. auth.
FAJERMAN, H., *with* **DAELS, F.,** jt. auth.
FALDELLA, G. (ab.), Direct roentgen therapy through small fields of pulmonary tuberculosis, April, 518.
FARIÑAS, PEDRO L., Value of x-ray examination of sella turcica in sagittal positions, April, 411.
FARRELL, MALCOLM J. (ab.), Use of prostigmin as preparation for abdominal roentgenography, Jan., 123.
FARROW, J. H., *with* **QUIMBY, EDITH H.,** jt. auth.
FAUST, J. J. (ab.), Treatment of gas gangrene infections, April, 506.
FAWCITT, RICHARD (ab.), Occupational diseases of lungs in agricultural workers, April, 512.
FEHR, W. (ab.), Modern high milliamperage and high voltage apparatus for roentgen deep therapy, June, 746.
FEID, LOUIS, Jr. (ab.), Use of radium in treatment of uterine fibroids, Jan., 122.
FEISTMANN-LUTTERBECK, E. (ab.), Changes in vertebral column following tetanus, May, 645.
FELDMAN, MAURICE, Cholecystography: single-dose *versus* the double-dose methods of administering dye, Feb., 155.
Idem, Roentgenologic consideration of gastritis, June, 726.
FERREIRA, ANTONIO E. MENDES, *with* **RIVERS, ANDREW B.,** jt. auth.
FETTER, THEODORE R. (ab.), Renal carcinoma: study of 95 cases, with follow-up notes on 36, April, 509.
FIGI, FREDERICK A. (ab.), Tumors of larynx, May, 632.
FINCHER, EDGAR F., and WALKER, EXUM B. (ab.), Displacement of intervertebral cartilage as cause of back pain and sciatica, March, 366.
FINE, ARCHIE, and BROWN, SAMUEL, Calcified scrotal tumor, Jan., 92.
FINE, ARCHIE, *with* **BROWN, SAMUEL,** jt. auth.
FINOCCHIARO, JOSÉ, *with* **CORREIA NETO, ALIPIO,** jt. auth.
FINOCHIETTO, E., *with* **UDAONDO, C. BONORINO,** jt. auth.
FISCHEL, E. (ab.), Some experimental studies of action of short waves on process of healing of fractures, Feb., 258.
FITZPATRICK, P. F. (ab.), Artificial pneumothorax in children, April, 513.
FLEMING, BRUCE L. (ab.), Cystic hygroma of neck, Jan., 129.
FORSSMAN, GÖSTA, *with* **WESTERMARK, NILS,** jt. auth.
FRAIN *with* **GUILBERT,** jt. auth.
FRANK, IRA (ab.), Papilloma of tonsil, with report of three cases, March, 387.
FRANKLIN, K. J., *with* **BARCLAY, A. E.,** jt. auth.
FRAY, WALTER W., *with* **KALTREIDER, NOLAN L.,** jt. auth.
FRAY, WALTER W., and POMMERENKE, WESLEY T., Roentgenographic pelvimetry and fetalometry: elimination of errors due to movements between x-ray exposures, March, 261.
FREY, W. (ab.), Diagnosis of cardiac enlargement, April, 509.
FRICKE, ROBERT E., *with* **BOWING, HARRY H.,** jt. auth.
FRIEDEWALD, WILLIAM F., and EWING, AGNEW R. (ab.), Isolated calcified aortic stenosis, Feb., 259.
FROMENT, J., CROIZAT, P., and MASSON, R. (ab.), Radiculo-medullary compression in course of malignant granulomatosis, Jan., 125.
FROSTBERG, NILS (ab.), Characteristic duodenal deformity in cases of different kinds of peri-vaterial enlargement of pancreas, March, 381.
FRUCHTER, JOSEPH M., *with* **BRUCK, SAMUEL,** jt. auth.
FULLER, CHARLES K. (ab.), Unusual head injury, March, 385.
FULTON, J. STRUTHERS, *with* **PATERSON, R. S.,** jt. auth.

GAILLARD, C. (ab.), Practical pulmonary stratigraphy, June, 747.
GAITHER, ERNEST H., and BORLAND, JAMES L. (ab.), Gastroscopic studies, Jan., 126.
GALIFI, LIBORIO (ab.), Unusual case of invagination of pylorus into duodenum, Feb., 255.
GARCIA-CALDERÓN, J., *with* **LEDOUX-LEBARD, R.,** jt. auth.
GARLAND, L. HENRY, Raymond Griswold Taylor: An appreciation, Jan., 108.
Idem (ab.), Roentgen treatment of certain hemorrhagic disorders, March, 385.
Idem, X-ray rentals in hospitals: analysis of current rental costs in hospitals and medical buildings, Jan., 46.
GARLAND, L. HENRY, *with* **CHENEY, GARNETT,** jt. auth.
GARRAHAN, C. JUSTUS, *with* **PENDERGRASS, EUGENE P.,** jt. auth.
GASSMANN, W. (ab.), Superficial radiotherapy: contact radiotherapy (Chaoul), May, 639.
GAUCHER *with* **ROEDERER,** jt. auth.
GAUSS, C. J. (ab.), Development of gynecological radium therapy, especially in treatment of non-malignant disease, May, 642.
GEISSBERGER, HANS, Table for use in radiography of infants' chests, Jan., 96.
GÉRARD, L., *with* **LÉON-KINDBERG,** jt. auth.
GERRIE, J. W. (ab.), One hundred broken noses, March, 380.
GERSHON-COHEN, J., and STRICKLER, ALBERT (ab.), Roentgenologic examination of normal breast: evaluation in demonstrating early neoplastic changes, March, 368.
GESCHICKTER, CHARLES F., and MASERITZ, I. H. (ab.), Primary hemangioma involving bones of extremities, Feb., 250.
GHORMLEY, RALPH K., SUTHERLAND, CHARLES G., and POLLOCK, GEORGE A. (ab.), Pathologic fractures, Feb., 258.
GIFFORD, MYRNIE A., *with* **DICKSON, ERNEST C.,** jt. auth.
GILBERT, RENÉ (ab.), Treatment of malignant granulomas by radiotherapy, May, 648.
GILLESPIE, JAMES B., *with* **SIEGLING, JOHN A.,** jt. auth.
GILMOUR, W., *with* **NEIL, J. HARDIE,** jt. auth.
GIRARD, M., *with* **SAVY, P.,** jt. auth.
GLEIZE-RAMBAL, L. (ab.), Causes and results of colospasms, Feb., 255.
GOLDEN, ROSS, Responsibility of radiologist in training of hospital intern in fluoroscopy (ed.), Feb., 235.
GOLDENBERG, RAPHAEL R. (ab.), Traumatic dislocation of hip followed by Perthes' disease, March, 375.
GOLOB, MEYER, Cardiospasm: report of case, April, 481.
GRAF, J., *with* **GRAF, L.,** jt. auth.
GRAF, L., and GRAF, J. (ab.), Problem of potential in deep therapy, Jan., 122.
GRAVES, W. N. (ab.), Solitary diverticulitis of cecum, Feb., 258.
GRAY, LAMAN A., *with* **WHARTON, LAWRENCE R.,** jt. auth.
GREENBERGER, EDWARD D. (ab.), Carcinoma of cervix and breast: prognosis and preferable therapy, March, 370.
GREINER *with* **CANUYT,** jt. auth.
GRIGSBY, GUY P., and KAPLAN, SIDNEY E. (ab.), Intussusception in infancy and childhood, Jan., 117.
GRLLI, ADAMO (ab.), Radiological aspect of early and advanced gas gangrene, April, 506.
GROOVER, THOMAS A., Partnerships of radiologists (ed.), May, 617.
GROSSMANN, G. (ab.), Spectral distribution of heterogeneous beam of roentgen rays, Jan., 122.
GROUT, J. L. A. (ab.), Silicosis in grinders, April, 516.
GUARINI, CARLO (ab.), Roentgen therapy in dermatology, May, 644.
GUIBAL *with* **LAMARQUE,** jt. auth.
GUIDOTTI, CARLO (ab.), Case of echinococcus of spine difficult to interpret roentgenologically, May, 645.
GUILBERT, TORTAT, FRAIN, and Le GUERN (ab.), Involution of uterine cavity after irradiation of fibromas, May, 649.
GUILD, HARRIET G., *with* **WHARTON, LAWRENCE R.,** jt. auth.
GUNSETT, A. (ab.), Radiobiology and radiation therapy, April, 514.
GUNSETT *with* **CANUYT,** jt. auth.
de GUNTEN, P. (ab.), Pneumatization of facial bones in Crouzon's disease, Apert's disease, and oxycephaly, March, 384.
GWYNNE, F. J., *with* **NEIL, J. HARDIE,** jt. auth.

HADLEY, LEE A. (ab.), Pathologic conditions of spine: painful disturbances of intervertebral foramina, Jan., 124.
HADLEY, W. SAMPSON (ab.), Chronic mastitis and breast cancer: family history of five sisters, Feb., 250.
HAGGART, GILBERT E., *with* **BARTELS, ELMER C.,** jt. auth.
HALDIN-DAVIS, H. (ab.), Treatment of plantar warts: clinical memorandum, April, 520.
HALL, M. R. (ab.), Roentgenological diagnosis of volvulus of sigmoid megacolon, with report of two cases, Jan., 117.
HALPERT, BÉLA, *with* **D'AUNOY, RIGNEY,** jt. auth.
HARE, HUGH F., *with* **HURXTHAL, L. M.,** jt. auth.
HARPER, R. A. KEMP (ab.), Silicosis in pottery workers, April, 516.
HARRINGTON, LEO A., *with* **RENDICH, RICHARD A.,** jt. auth.
HARRIS, T. T., *with* **HICKEN, N. FREDERICK,** jt. auth.
HARRIS, WILLIAM, *with* **BERCK, MAURICE,** jt. auth.
HARRISON, EDWARD K., and REEVES, ROBERT J., Roentgen treatment of leukemia, with report of pregnancy in case of lymphatic leukemia, March, 284.
HARVEY, E. (ab.), Urinary prolans in cancer cases, Feb., 252.
HARVIER, P., MALLARMÉ, J., and LEDOUX-LEBARD, GUY (ab.), Generalized form of Paget's disease with diffuse involvement of small bones of extremities, Feb., 250.
HAYDEN, CHARLES THOMAS (ab.), Roentgen-ray pelvimetry, Jan., 120.
HEATLY, CLYDE A., *with* **DOWDY, ANDREW H.,** jt. auth.
HEB, P. (ab.), Roentgen therapy of chronic tonsillitis, March, 386.
HELLPAP, W., *with* **LOHR, R.,** jt. auth.
HELLWIG, C. A., and WARFIELD, C. H. (ab.), Bone tumors, March, 368.
HENDERSON, W. R. (ab.), Anterior basal meningiomas, Jan., 128.
HENNARD, E. (ab.), Undiagnosed luxations of shoulder, April, 516.
HENSCHKE, U. (ab.), Dependence of ionization current on volume of small ionization chambers, Feb., 247.
HENSHAW, PAUL S., Radiosensitivity and recurrent growth in *Obelia,* April, 466.

HEPLER, ALEXANDER B. (ab.), Non-obstructive dilatations of upper urinary tract in children, April, 507.
HERB, R. G., *with* PARKINSON, D. B., jt. auth.
HERSKOWITS, EUGEN (ab.), Two cases of cystic dilatation of lower thirds of left ureters, April, 507.
HESS, ELMER (ab.), Sarcoma of prostate and adjacent retrovesical structures, April, 513.
HETHERINGTON, H. W. (ab.), Diagnosis and management of latent, suspected, and early clinical tuberculosis, April, 518.
HICKEN, N. FREDERICK, *with* BEST, R. RUSSELL, jt. auth.
HICKEN, N. FREDERICK, BEST, R. RUSSELL, HUNT, HOWARD B., and HARRIS, T. T. (ab.), Roentgen visualization and diagnosis of breast lesions by means of contrast media, March, 368.
HIEBERT, P. E., *with* ALLEN, LEWIS G., jt. auth.
HIGINBOTHAM, NORMAN L., *with* COLEY, BRADLEY L., jt. auth.
HILL, FREDERICK T. (ab.), Mixed tumors of hard palate, March, 389.
HIPPS, HERBERT E. (ab.), New surgical procedure in acute infectious arthritis, Feb., 248.
HIRSCHI, H., and BODMER, H. (ab.), Therapy with radioactive emanation, April, 515.
HOCHBERG, LEW A., Roentgenographic images in primary carcinoma of lung, June, 713.
HOCHBERG, LEW A., *with* NATHANSON, LOUIS, jt. auth.
HOCKER, ALFRED F., *with* BLADY, JOHN V., jt. auth.
HODES, PHILIP J., *with* PENDERGRASS, EUGENE P., jt. auth.
HOEDE, K. (ab.), Report of acute roentgen injury, April, 514.
HODGES, FRED M., and SNEAD, L. O., Roentgen therapy of carefully selected sinus infections, June, 669.
HOFF, F., *with* NEEFF, T. C., jt. auth.
HOLFELDER, H., and BERNER, F. (ab.), Standing and prospects of miniature photographs from roentgen screen, June, 746.
HOLINGER, PAUL H. (ab.), Rôle of inflammatory bronchial stenosis in etiology of bronchiectasis, June, 749.
HOLLAENDER, ALEXANDER, Present status of mitogenetic radiation, April, 404.
HOLLDACK, F. (ab.), Rare disturbances of osseous cartilaginous growth, March, 366.
HOLMGREN, BENGT S. (ab.), Case of genuine invagination of colon, Feb., 254.
Idem (ab.), Variations in x-ray appearance of normal first metatarso-phalangeal joint due to changes in direction of central ray, April, 505.
HOLTHUSEN, H. (ab.), Biologic effect of roentgen rays, April, 514.
HORSLEY, J. S. (ab.), Symptoms, diagnosis, and treatment of cancer of stomach, March, 385.
HORTON, BAYARD T., *with* MILLS, JOHN H., jt. auth.
HOWARD, HERBERT H., and SUBY, HOWARD I. (ab.), Perirenal fibrosarcoma, March, 377.
HOWES, WILLIAM E., Planigraphy—application to thoracic diagnosis, May, 556.
HOWES, WILLIAM E., and SCHENCK, SAMUEL GEORGE, Bronchogenic carcinoma: study of eight autopsied cases, Jan., 8.
HRABOVSZKY, A. (ab.), Early results of near distance radiation in carcinoma of skin and lip, Feb., 254.
HUBENY, MAXIMILIAN J., and DELANO, PERCY J., Paraplegia from erosion of vertebral column by large thoracic aneurysm, Feb., 171.
Idem, Plea for more frequent use of lateral roentgenogram in diagnosis of pregnancy, May, 546.
HUDSON, J. CRAMER, Physical measurements on roentgen radiation from tube actuated by Van de Graaf generator, May, 530.
HUGUENIN, ANDRÉ, *with* MARILL, F.-G., jt. auth.
HUGUENIN, ANDRÉ, *with* RAYNAUD, R., jt. auth.
HUIZINGA, EELCO, *with* BEHR, E., jt. auth.
HUNT, HOWARD B., *with* HICKEN, N. FREDERICK, jt. auth.
HUNT, HOWARD B., and POPMA, ALFRED M., "Excretory urography by intramuscular injection of diodrast," Authors' note on, Jan., 113.
HURXTHAL, L. M., and HARE, HUGH F., Bone changes in primary hypogonadism, May, 521.

INOUYE, K. (ab.), Biological effects of alpha rays, with special consideration of problems of radium therapy using extremely low doses, May, 641.
INTER-SOCIETY COMMITTEE FOR RADIOLOGY, General welfare of radiology, M. F. Cahal, Jan., 98; Points of interest, M. F. Cahal, Feb., 228; Economic status of radiologist under socialized medicine: report on Germany, S. W. Donaldson, March, 351; Economic status of radiologist under socialized medicine: report on England, S. W. Donaldson, April, 486; Who shall practise medicine? M. F. Cahal, May, 611; Points of interest, M. F. Cahal, June, 736.

JACOX, HAROLD W. (ab.), Treatment of skin malignancy by irradiation, March, 369.
Idem, Recovery following human ovarian irradiation, May, 538.
JACOX, HAROLD W., MAJOR, GLENN, and BAKER, MARGARET R., Multiple heteromorphologic malignant tumors of uterus, Jan., 51.
JAFFÉ, RICHARD H., *with* PORTIS, SIDNEY A., jt. auth.
JEFFERSON, GEOFFREY (ab.), Saccular aneurysms of internal carotid artery in cavernous sinus, April, 508.
JENKINS, I. WARNER, Treatment of hyperthyroidism, with consideration of other of ductless glands as trigger mechanism: based upon observation of 360 cases, March, 340.
JENKINSON, EDWARD L., Henry Schmitz, June, 743.
JÉSOVER *with* ROEDERER, jt. auth.
JESSEL, GEORGE (ab.), Skiagraphy of chest, Jan., 119.
JOCHIM, K., *with* KATZ, L. N., jt. auth.
JOHN, F. (ab.), Roentgen late injuries, April, 515.
JOHNSON, G. H. (ab.), Factors relating to treatment of cervix uteri, March, 390.
JOHNSON, VINCENT C., Value of roentgen examination of paranasal sinuses, March, 303.
JONES, E. MENDELSSON (ab.), Diaphragmatic hernia, March, 373.
JONES, OSWALD R., and BURFORD, GEORGE E. (ab.), Massive atelectasis following cyclopropane anesthesia: report of cases and theory of cause and prevention, March, 378.
JONES, W. A. (ab.), Points of mutual interest to general practitioner and radiologist, Jan. 122.
JOSTES, FREDERICK A., and ROCHE, MAURICE B. (ab.), Syphilis of bones and joints, May, 645.
JULIÁN, ORMAND C., Large pedunculated lipoma of colon nine years after resection of carcinoma of colon, April, 479.
JUTRAS, ALBERT, *with* ROY, J. N., jt. auth.

KAGAMI, Y. (ab.), Experimental study on effect of change of environments of animal cells on their radiosensitivity, April, 501.
KALTREIDER, NOLAN L., and FRAY, WALTER W. (ab.), Pathological physiology of pulmonary cysts and emphysematous bullæ, May, 633.
KAMEN, MARTIN D., *with* WILSON, ROBERT R., jt. auth.
KAPLAN, H. A., *with* KATZ, L. N., jt. auth.
KAPLAN, SIDNEY E., *with* GRIGSBY, GUY P., jt. auth.
KATZ, L. N., MENDLOWITZ, M., and KAPLAN, H. A., with assistance of **JOCHIM, K., and LINDNER, E.** (ab.), Action of digitalis on isolated heart, April, 508.
KEILHACK, HANS (ab.), Roentgenologic demonstration of papilloma of kidney pelvis, March, 377.
KELLY, JAMES F., and DOWELL, D. ARNOLD, Roentgen treatment of acute peritonitis and other infections with mobile x-ray apparatus, June, 675.
KELTON, WALTER (ab.), Plantar wart, April, 520.
KESMODEL, K. F., *with* MEADOWS, J. A., jt. auth.
KHAYAT, Z., *with* SAVY, P., jt. auth.
KHOO, F. Y. (ab.), Calcification in angiomas, Jan., 128.
KILLICK, ESTHER M. (ab.), Tests of respiratory efficiency and their correlation with radiological appearances in lungs April, 511.
KING, DONALD S. (ab.), Primary cancer of lung, April, 511.
KINGDON, K. H., and TANIS, H. E., Jr. (ab.), Experiments with condenser discharge x-ray tube, Feb., 247.
KLOTZ, MAX O. (ab.), Association of silicosis and carcinoma of lung, May, 634.
Idem (ab.), Primary carcinoma of lung, Feb., 252.
KNAPP, M. E., Treatment of erysipelas with ultra-violet energy, Feb., 195.
KNOFLICEK, E. J. (ab.), Chorionepithelioma in male, March, 388.
KNOLL, WILLIAM V., *with* BAILEY, WILBUR, jt. auth.
KÖRBLER, J. (ab.), Radium therapy of carcinoma of skin and lip, March, 383.
KORNBLUM, KARL, and RITTER, JOSEPH A., Retroperitoneal cyst with agenesia of kidney, April, 416.
KOUCKY, RUDOLPH, *with* RIGLER, LEO G., jt. auth.
KUBAT, ANTON (ab.), Extensive calcifications in breast, March, 368.
KUHNS, JOHN G. (ab.), Chronic arthritis of shoulder, Feb., 248.
KUZMA, WACLAW (ab.), Teratomas and dermoid cysts, May, 646.

LABORDE, S. (ab.), Cancer of cervix: therapeutic and biological thoughts, April, 520.
LACKEY, ROBERT W., *with* METZ, M. HILL, jt. auth.
LADD, WILLIAM E. (ab.), Embryoma of kidney (Wilms' tumor), April, 510.
LAFITTE, ABEL, *with* CARNOT, PAUL, jt. auth.
LAINÉ *with* DANO, jt. auth.
LAMARQUE and BÉTOULIÈRES (ab.), Acute arthritis developing in hip joint presenting lesions of post-traumatic coxarthritis, March, 374.
LAMARQUE, GUIBAL, and BÉTOULIÈRES (ab.), Acute iodism following intravenous pyelography, April, 504.
LAMARQUE, P. (ab.), Historadiography, April, 501.
LAMARQUE, P., *with* TERRACOL, J., jt. auth.
LAMOUREAUX *with* POIRIER, jt. auth.
LARSON, LAWRENCE M. (ab.), Fundamentals in surgical treatment of colon disorders, Feb., 254.
LEAVELL, BYRD S. (ab.), Chronic leukemia: study of incidence, and factors influencing duration of life, Jan., 118.
LECLERC, GEORGES-CLAUDE (ab.), Radiosensitivity of Ewing's tumor, May, 648.

LEDOUX-LEBARD, GUY, *with* **HARVIER, P.,** jt. auth.
LEDOUX-LEBARD, R. (ab.), Roentgen therapy of Paget's disease of bone, March, 367.
LEDOUX-LEBARD, R., GARCIA-CALDERON, J., and DJIAN, ALBERT (ab.), Radiography of larynx, anterior view, and technic, May, 632.
LEE, THOMAS B. (ab.), Treatment of myoma uteri, May, 650.
Le GUERN *with* **GUILBERT,** jt. auth.
LEICHTI, A. (ab.), Greinacher "spark" counter for measurement of very small quantities of roentgen and radium rays, Feb., 248.
LÉON-KINDBERG and GÉRARD, L. (ab.), Presentation of several pulmonary "biotomes" taken with apparatus of Bocage, Feb., 247.
LEPENNETIER, F. (ab.), Treatment of Chauffard-Still's disease, March, 385.
LEVENSON, CARL L. *with* **BIERMAN, WILLIAM,** jt. auth.
LEVIE, B., *with* **den HOED, D.,** jt. auth.
LEVINA, R. I. (ab.), Influence of hyperthyroidism and hypothyroidism on gastric evacuation, March, 386.
Idem (ab.), Influence of pituitrin on evacuation of stomach, Jan., 126.
LI, S. T. (ab.), Cold screening in low-power radiography, April, 501.
LIDZKI, A. (ab.), Dermoid cyst of bladder, June, 749.
LIEBERMAN, HERMAN S. (ab.), Hodgkin's disease of bones, March, 367.
LIECHTI, A., MINDER, W., and MÜLLER, J. H. (ab.), Radiobiological experiments with pupæ of *Drosophila*, April, 502.
LIGNAC, G. O. E. (ab.), Syndrome consisting of affections of kidney, stunted growth, rickets, and disturbed cystine metabolism, March, 376.
LINDNER, E., *with* **KATZ, L. N.,** jt. auth.
LOCKWOOD, IRA H. (ab.), Primary carcinoma of bronchus, June, 752.
LOCKWOOD, IRA H., and BELL, CHARLES, E. (ab.), Radiation therapy of primary hemangioma of vertebræ, May, 644.
LOHR, R., and HELLPAP, W. (ab.), Roentgen image of joint space at knee, April, 511.
LONG, LEONARD, Simple apparatus for visualization of sinus tracts, June, 733.
LOSSEN, HEINZ (ab.), Chronic appendicitis and x-ray study, April, 501.
LOUGHRIDGE, DONALD H., *with* **TRUEBLOOD, HAROLD C.,** jt. auth.
LOVE, J. GRAFTON (ab.), Intractable low back and sciatic pain due to protruded intervertebral disks: diagnosis and treatment, June, 748.
LOVE, WILLIAM H., Efficiency curves in quantitative radiobiology, June, 708.
de LUCA, G. (ab.), Compression of vertebra by hemangioma which was clinically cured by radiotherapy, May, 644.
de LUCA, V. (ab.), Regression of contralateral tuberculous lesions after monolateral therapeutic pneumothorax, May, 638.
LUTHER, W. (ab.), Radiosensitivity and cell division, Feb., 249.
LUTZ, J. FLETCHER, and PUSCH, LEWIS C., Osteogenesis imperfecta tarda, April, 391.
LUTZ, W., and SEYFRIED, H. (ab.), Danger of intravenous cholecystography, April, 506.
LYNCH, KENNETH M. (ab.), Pulmonary asbestosis. IV.—Asbestos body and similar objects in lung, March, 380.

McALISTER, L. S. (ab.), Roentgen therapy, Feb., 253.
McCARTHY, J. E., *with* **BROWN, SAMUEL,** jt. auth.
McCHESNEY, GEORGE J., CARROLL, ROBERT L., and DAVIS, KENNETH S. (ab.), Bone tumors, March, 368.
McCLELLAND, JAMES C., and MILLS, JESSE R. F. (ab.), Renal tumors, March, 389.
McCURRICH, H. J. (ab.), Calcification of bursa of coracoclavicular ligament, April, 503.
McDONALD, STUART, Jr. (ab.), Observations on chorionepithelioma testis, with record of case, March, 388.
McFETRIDGE, ELIZABETH M., *with* **ROMANO, SAMUEL A.,** jt. auth.
McKEEVER, DUNCAN C. (ab.), Fractures of os calcis, April, 505.
McKIBBEN, J. L., *with* **PARKINSON, D. B.,** jt. auth.
MacVICAR, WARWICK, *with* **PATERSON, RALSTON,** jt. auth.
MACBETH, R. G., *with* **BARCLAY, A. E.,** jt. auth.
MAESTRI, O. (ab.), Spontaneous cure of some forms of pulmonary tuberculosis, April, 519.
MAGNUSSON, W. (ab.), Conditions responsible for radiographic visualization of "true joint fissure," Feb., 260.
MAIN, WALLACE, *with* **NEIL, J. HARDIE,** jt. auth.
MAITLAND, D. G. (ab.), Radiological aspect of treatment of ureteric calculus, March, 368.
MAJOR, GLENN, *with* **JACOX, HAROLD W.,** jt. auth.
MALLARMÉ, J., *with* **HARVIER, P.,** jt. auth.
MANDEVILLE, FREDERICK B., *Aloe vera* in treatment of radiation ulcers of mucous membranes, May, 598.
MARC, H., and SIRE (ab.), Gastric syphilis, pseudoneoplastic type: clinical and radiologic study, May, 645.
MARCHIONI, R., *with* **BERNASCONI, FR.,** jt. auth.
MARCLEY, DAVID M., *with* **BROWN, PHILIP W.,** jt. auth.
MARILL, F.-G., RAYNAUD, R., and HUGUENIN, ANDRE (ab.), Remarks on vertebral cancer, April, 517.
MARINELLI, L. D., *with* **QUIMBY, EDITH H.,** jt. auth.
MARQUIS *with* **BELOT,** jt. auth.
MARZOCCHI, GUALTIERO (ab.), Size, variability, and correlation of heart at puberty, Feb., 259.
MASERITZ, I. H., *with* **GESCHICKTER, CHARLES F.,** jt. auth.
MASSA, J. (ab.), New position for radiologic examination of shoulder joint in profile, April, 516.
MASSIOT, J. (ab.), Presentation of biotome of Bocage and of planigraph of Ziedses des Plantes, June, 747.
MASSON, R., *with* **FROMENT, J.,** jt. auth.
MATTICK, WALTER L., and BURKE, EUGENE M. (ab.), Primary bronchogenic carcinoma from pathologic and radiologic points of view, Feb., 252.
MATZ, PHILIP B. (ab.), Study of silicosis, March, 384.
MAXWELL, J. H. (ab.), Management of septic patient with otitis media, Jan., 120.
MAY, HANS, *with* **ENGEL, GILSON C.,** jt. auth.
MAYER, A. (ab.), Thirty years' experience in treatment of carcinoma of uterus, March, 390.
MAYER, KAROL, X-ray inquiry into genesis of current of venous blood and lymph, March, 275.
MEADOWS, J. A., and KESMODEL, K. F. (ab.), Roentgen diagnosis and treatment of benign giant-cell tumor of bone, March, 367.
MELLINGER, WILLIAM J. (ab.), Base of skull, with particular reference to fractures, March, 372.
MELTZER, SARA, *with* **CAMERON, A. T.,** jt. auth.
MENCHER, WILLIAM H. (ab.), Perirenal insufflation, Jan., 121.
MENCHER, WILLIAM H., *with* **BEER, EDWIN,** jt. auth.
MENDELSOHN, S. N., and SCHRIVER, L. H. (ab.), Lipiodol in treatment of persistent fecal fistula after appendectomy, April, 501.
MENDLOWITZ, M., *with* **KATZ, L. N.,** jt. auth.
MESIROW, SIDNEY D., *with* **REIS, RALPH A.,** jt. auth.
du MESNIL de ROCHEMONT, R. (ab.), Determination of dose in "rotation" irradiation, March, 372.
Idem (ab.), Is it possible to use radium bomb for intravaginal treatment of carcinoma of uterus and would it be possible to improve considerably distribution of radiation? April, 515.
METZ, M. HILL (ab.), Gastric lesion produced by posterior pituitary extract, Jan., 125.
METZ, M. HILL, and LACKEY, ROBERT W. (ab.), Peptic ulcer treated by posterior pituitary extract, Jan., 120.
MEYER, WILLIAM H., Co-relation of physical and clinical data in radiation therapy, Jan., 23.
MEYERDING, HENRY W. (ab.), Results of treatment of osteogenic sarcoma, March, 388.
MEYER-WILDISEN, ROBERT (ab.), Technic of air injection of joints, Feb., 260.
MIALARET, J., *with* **ROUX, JEAN-CHARLES,** jt. auth.
de MICHELIS, U., and CONTE, E. (ab.), Effect of unilateral pneumothorax on pre-existing tuberculous lesions in opposite lung (study of 200 cases), April, 513.
MIDDELDORPF, K., *in collaboration with* **SAUERBRUCH, F.**
von MIKULICZ-RADECKI, F. (ab.), Treatment of carcinoma of cervix in Women's Clinic of University of Königsberg from 1910 to 1937, March, 390.
MILHAUD, M., *with* **CADE, A.,** jt. auth.
MILLER, EARL R., Carcinoma of thymus, with marked pulmonary osteo-arthropathy, June, 651.
MILLER, RUSSEL F., *with* **WIDMANN, BERNARD P.,** jt. auth.
MILLS, EDWARD S. (ab.), Thalassanemia, May, 646.
MILLS, JESSE R. F., *with* **McCLELLAND, JAMES C.,** jt. auth.
MILLS, JOHN H., and HORTON, BAYARD T. (ab.), Clinical aspects of aneurysm, June, 746.
MINDER, W. (ab.), Significance of primary and secondary beta rays in radium therapy, March, 383.
MINDER, W., *with* **LIECHTI, A.,** jt. auth.
MITRA, SUBODH (ab.), Radiation therapy in gynecology, March, 384.
MOERSCH, HERMAN J. (ab.), Hiatal hernia, March, 374.
MONMIGNAUT *with* **MORO, J.,** jt. auth.
MOONEY, VOIGT, Convenient lantern-slide exhibition rack, April, 476.
MOORE, SHERWOOD, *with* **SCOTT, WENDELL G.,** jt. auth.
MORELLI, ALBERTO C. (ab.), Systolic expansion of heart's ventricles, April, 508.
MOREY, JOHN B., and SOSMAN, MERRILL C., Spontaneous mediastinal emphysema, with report of case associated with spontaneous pneumothorax, Jan., 19.
MORO, J., and MONMIGNAUT (ab.), Case of hemorrhagic metritis cured by roentgen irradiation of hypophysis, April, 507.
MORR, H. (ab.), Roentgen image of encapsulated left diaphragmatic pleurisy, March, 379.
MOSTO, D., *with* **UDAONDO, C. BONORINO,** jt. auth.
MOURGUES *with* **DREVON,** jt. auth.
MÜLLER, HEINRICH (ab.), Limitations of internal medical treatment of gastric and duodenal ulcers, March, 381.
MÜLLER, J. H., *with* **LIECHTI, A.,** jt. auth.
MÜLLER, R. (ab.), Results of roentgen and radium therapy in carcinoma of larynx and hypopharynx, April, 503.
MUMFORD, E. B. (ab.), Roentgen therapy in acute osteoporosis, March, 367.
MUSCHAT, MAURICE (ab.), Diagnostic problems in surgical kidney disease, April, 510.
MUTSCHELLER, A., Relation between radiation quality factors and depth, Jan., 87.
MYERS, RALPH E. (ab.), Radiation therapy in primary neoplasms of lung, March, 379.
Idem (ab.), Treatment of carcinoma of cervix uteri, March, 369.

NAHAN *with* **BELOT,** jt. auth.
NATHANSON, LOUIS, Shadow of cardiac end of stomach simulating soft tissue tumefaction in supine position, April, 473.
NATHANSON, LOUIS, HOCHBERG, LEW A., and PERLMAN, ROBERT (ab.), Superior pulmonary sulcus tumor simulating subacromial bursitis, March, 388.
NAVID, H. H. (ab.), Scope of radiotherapy, March, 384.
NEBOUT, J., *with* **DECHAMBRE, S.,** jt. auth.
NEEFF, T. C. (ab.), Development of treatment methods for uterine carcinoma at Women's Clinic of University of Würzburg, May, 649.
NEEFF, T. C., and HOFF, F. (ab.), Avoidance of injurious effects on bladder in radiation therapy of carcinoma of uterus, June, 749.
NEIL, J. HARDIE, GILMOUR, W., GWYNNE, F. J., MAIN, WALLACE, and FAIRCLOUGH, W. A. (ab.), Anatomy of bronchial tree and clinical application, June, 750.
NEMOURS-AUGUSTE (ab.), Error of technic in administration of tetraiodide with intolerance and prolonged visibility of gall bladder, April, 505.
NEU, L., and NEU, V. (ab.), Cyclic character of effect of roentgen rays, April, 514.
NEU, V., *with* **NEU, L.,** jt. auth.
NEUHOFF, HAROLD, and TOUROFF, ARTHUR S. W. (ab.), Acute aerobic (non-putrid) abscess of lung, April, 512.
NEWCOMER, ELIZABETH, Treatment of carcinoma of breast: technic, complications, and results, Feb., 161.
NEWCOMER, NATHAN B., Joint changes in hemophilia, May, 573.
NEWELL, R. R., Language of engineers and radiologists: new x-ray terms proposed: rhegma, rhothion, kludon, plem, aith, March, 270.
NICHOLS, B. H. (ab.), Acute intestinal obstruction, Jan., 118.
NOGIER, T. (ab.), Calculus of bladder in case previously treated for cancer of cervix, March, 369.
Idem (ab.), Danger of introducing radio-active substances into body of mammals: experience with two mares, May, 642.
NORGAARD, FLEMMING (ab.), Peptic ulcer of esophagus, May, 636.
NOTKIN, LOUIS J. (ab.), Early diagnosis of cancer of stomach, June, 752.

OCKERBLAD, NELSE F., and CARLSON, HJALMAR E. (ab.), Malignant papillary cystadenoma in double kidney, April, 510.
OERTEL, HORST (ab.), "Romantic" attributes of "lawlessness" and "malignancy" in cancer, June, 751.
OGDEN, MICHAEL ALEXANDER, *with* **D'AUNOY, RIGNEY,** jt. auth.
ORLEY, A. (ab.), X-ray pelvimetry, Jan., 120.
OSGOOD, HERMAN A., Treatment of acute and chronic inflammatory conditions by fractional doses of x-ray, March, 311.
OSTRUM, HERMAN W., *with* **WIDMANN, BERNARD P.,** jt. auth.
OTT, P., *with* **ESSER, C. H.,** jt. auth.
OVERGAARD, KRISTIAN (ab.), Schmorl's cartilage islands, Jan., 125.

PARKER, HERBERT M., Dosage measurements by simple computations, May, 591.
PARKINSON, D. B., HERB, R. G., BERNET, E. J., and McKIBBEN, J. L. (ab.), Electrostatic generator operating under high air pressure—operational experience and accessory apparatus, Feb., 248.
PARSONS, J. G. (ab.), Acute mastoiditis, May, 635.
PASCHETTA, VINCENT (ab.), Double ulcer of stomach: radiographs and specimen, May, 636.
PATEK, ARTHUR J. (ab.), Dissecting aneurysm of aorta: clinical recognition, April, 509.
PATERSON, RALSTON, Value of assessing and prescribing dosage in radiation therapy in simple terms, Feb., 221.
PATERSON, RALSTON, and MacVICAR, WARWICK (ab.), Construction of superficial applicators for radium therapy, April, 515.
PATERSON, R. S., FULTON, J. STRUTHERS, and SANKEY, R. J. (ab.), Discussion on planning and organization of radiological department in general hospital, May, 639–641.
PAUL, LESTER W., Radiography of parotid duct, May, 609.
PENDERGRASS, EUGENE P., HODES, PHILIP J., and GARRAHAN, C. JUSTUS, Roentgen therapy by method of Chaoul, Feb., 142.
PERLMAN, ROBERT, *with* **NATHANSON, LOUIS,** jt. auth.
PETERSON, ANDREW P. (ab.), Retrograde catheterization in diagnosis and treatment of seminal vesiculitis, Jan., 124.
PETT, ROBERT G. (ab.), Irradiation of cutaneous manifestations of lymphoblastoma, April, 520.
PHILLIPS, JOHN ROBERTS, Esophagopleural fistula: report of case, Jan., 91.
PICARD, M. (ab.), Necessity of systematic use of barium enemas to disclose latent intestinal tuberculosis in cases with pulmonary tuberculosis, Jan., 128.
PICKHAN, A. (ab.), Intra-uterine radium therapy of hemorrhagic metropathies, May, 641.
PICKHARDT, OTTO C., and RAFSKY, HENRY A. (ab.), Problems presented by lesions of right quadrant, March, 376.
PIERCE, WILLIAM W., *with* **DOWDY, ANDREW H.,** jt. auth.
PIERRET, COULOUMA P., BRETON, A., and DEVOS, L. (ab.), New conception of anatomical structure of lungs: pulmonary zones: clinical and radiological application, Jan., 119.
PILCHER, COBB (ab.), Bony intracranial tumors, May, 647.
van der PLAATS, G. J. (ab.), Roentgen caustic, March, 371.
PLAUT, H. F. (ab.), Fracture of atlas in automobile accidents: value of x-ray views for diagnosis, March, 372.
POHL, RUDOLF (ab.), Acute and chronic atelectases of lungs and their sequences, March, 379.
Idem (ab.), Roentgen diagnosis of diseases of pancreas, March, 381.
POIRIER and LAMOUREAUX (ab.), Pedunculated cancer of pylorus, April, 520.
POIROT, MARCEL (ab.), Diagnosis of chronic intestinal amebiasis, March, 376.
POLLOCK, GEORGE A., *with* **GHORMLEY, RALPH K.,** jt. auth.
POMEROY, LAWRENCE A. (ab.), Classification of tumors, Jan., 129.
POMMERENKE, WESLEY T., *with* **FRAY, WALTER W.,** jt. auth.
PONS, HENRI (ab.) Differential diagnosis of biliary and urinary calculi, June, 751.
POPMA, ALFRED M., *with* **HUNT, HOWARD B.,** jt. auth.
POPP, L. (ab.), Roentgen therapy of sinusitis, March, 385.
PORCHER, P. (ab.), Inorganic lacunar images of antrum, March, 386.
PORTIS, SIDNEY A., and JAFFÉ, RICHARD H. (ab.), Study of peptic ulcer based on necropsy records, Jan., 120.
POTTER, HOLLIS E. (ab.), Roentgenography of pulmonary tuberculosis, April, 518.
POULAIN, ANDRÉ (ab.), Vertebral metastasis from carcinoma of breast treated by teleroentgentherapy, Feb., 250.
POWELL, EUGENE V. (ab.), Roentgen therapy of lobar pneumonia, March, 382.
PRAEGER, WOLFGANG (ab.), Diagnosis of focal (dental) infection, especially by means of roentgenogram, Feb., 255.
PRIESTLEY, JAMES T., and BRAASCH, WILLIAM F. (ab.), Late results in conservative management of nephrolithiasis, March, 377.
PROPPE, A. (ab.), Technic of roentgen therapy of curved surfaces, March, 384.
PROUTY, JAMES V. (ab.), Regional enteritis, March, 376.
PUSCH, LEWIS C., *with* **LUTZ, J. FLETCHER,** jt. auth.
PUTNEY, F. JOHNSON, *with* **CLERF, LOUIS H.,** jt. auth.

QUIMBY, EDITH H., Measurement of tissue dosage in radiation therapy, May, 583.
UIMBY, EDITH H., MARINELLI, L. D., and FARROW, J. H. (ab.), Study of back-scatter, March, 371.

RAFSKY, HENRY A., *with* **PICKHARDT, OTTO C.,** jt. auth.
RAJEWSKY, B., Researches in problem of radium poisoning and tolerance dose of radium, Jan., 57.
RAMADOUT, M., *with* **CHENE, P.,** jt. auth.
RAWLINS, A. G. (ab.), Osteoma of maxillary sinus, March, 384.
RAY, BRONSON S., *with* **CARTY, JOHN RUSSELL,** jt. auth.
RAYNAUD, R., *with* **MARILL, F.-G.,** jt. auth.
RAYNAUD, R., HUGUENIN, A., and TILLIER, H. (ab.), Cranial and spinal lesions in epileptic: difficulties of interpretation, April, 505.
REDING, R. (ab.), Practical ideas concerning cancerology indispensable to practitioner, Feb., 253.
REEVES, ROBERT J., *with* **HARRISON, EDWARD K.,** jt. auth.
REILING, VICTOR G., *with* **COLLINS, GEORGE B.,** jt. auth.
REINEKE, HAROLD G. (ab.), Radiation therapy of infections, March, 376.
REINHARD, M. C., Note on use of clinical dosage meters using thimble ionization chamber, March, 282.
REIS, RALPH A., and MESIROW, SIDNEY D. (ab.), Studies in evaluation of mammography, April, 504.
RENANDER, AXEL (ab.), Roentgenological changes in lungs caused by acetylene gas, Jan., 119.
RENDICH, RICHARD A., and HARRINGTON, LEO A. (ab.), Roentgen kymography of normal colon: defecation in man, March, 371.
RHINEHART, D. A. (ab.), Significance of calcifications within the lungs, March, 380.
RIDPATH, ROBERT F. (ab.), Chordoma, with report of two cases, March, 387.
RIGLER, LEO G., Density of central shadow in diagnosis of intrathoracic lesions, March, 316.
RIGLER, LEO G., and KOUCKY, RUDOLPH (ab.), Roentgen studies of pathological physiology of bronchial asthma, June, 748.
RITTER, JOSEPH A., *with* **KORNBLUM, KARL,** jt. auth.
RIVERS, ANDREW B., and FERREIRA, ANTONIO E. MENDES (ab.), Incidence and causes of chronic dyspepsia at various ages: analysis of 4,223 cases, Feb., 256.
ROBBINS, O. F., *with* **UDE, WALTER H.,** jt. auth.
ROCHE, MAURICE B., *with* **JOSTES, FREDERICK A.,** jt. auth.
ROEDERER, C., and CHOFFAT (ab.), Case of vertebral disease, difficult to diagnose, in retrospect, May, 644.
ROEDERER, GAUCHER, and JÉSOVER (ab.), Calcification of meniscus and hypertrophic spurring, April, 517.

ROGERS, T. H., Effect of cable length on radiation output of shock-proof x-ray tubes, Feb., 202.
ROMANO, SAMUEL A., and McFETRIDGE, ELIZABETH M. (ab.), Limitations and dangers of mammography by contrast media, April, 504.
RONNEAUX, G., and WITASSE (ab.), Multiple diverticula of digestive tract, April, 506.
ROSE, CASSIE BELLE, Diagnosis of unusual calcareous shadows found on x-ray films of abdomen, May, 600.
ROSE, EDWARD, *with* **EDEIKEN, JOSEPH,** jt. auth.
ROSENTHAL, NATHAN, and BASSEN, FRANK A. (ab.), Course of polycythemia, April, 502.
ROSS, DUDLEY E. (ab.), Bilateral lobectomy for bronchiectasis, June, 750.
ROTHSTADT, L. E. (ab.), Radiological examination of heart, March, 373.
ROUBIER, C. (ab.), "Azotemic lung": radiographic study, May, 634.
ROUX, JEAN-CHARLES, and MIALARET, J. (ab.), Stenoses and false stenoses of intestine in course of grave anemias, Jan., 117.
ROVNER, LEOPOLD, *with* **WEINSTEIN, M. L.,** jt. auth.
ROY, J. N., and JUTRAS, ALBERT (ab.), Radiologic aspects of almost osteoperiostitis associated with hypertrophy of palpebral tarsi, the skin of face and extremities: a new syndrome, April, 502.

SABBIONE, CARLO (ab.), Radiological study of spontaneous rib fracture among tuberculous, Jan., 127.
SALZER, HARVEY M. (ab.), Frontal hyperostosis syndrome, April, 503.
SAMMET, JOEL F., Median rhomboid glossitis, Feb., 215.
SAMPSON, D. ALAN (ab.), Lung abscess due to esophageal overflow, May, 634.
SANKEY, R. J., *with* **PATERSON, R. S.,** jt. auth.
SAUERBRUCH, F., *in collaboration with* **MIDDELDORPF, K.** (ab.), Surgical standpoint regarding radiation therapy of malignant tumors, March, 389.
SAVY, P., GIRARD, M., and KHAYAT, Z. (ab.), Multiple ulcers of stomach and duodenum, Jan., 121.
SCADDING, J. G. (ab.), Chronic pneumonias, May, 637.
SCHENCK, SAMUEL GEORGE, *with* **HOWES, WILLIAM E.,** jt. auth.
SCHERESCHEWSKY, J. W. (ab.), Prevention and control of cancer: plan for nation-wide organization, Feb., 254.
SCHIEBER, M. (ab.), Schüller-Christian's disease, May, 643.
SCHINZ, HANS R., Passing on presidency (ed.), Jan., 105.
SCHMELA, W. W., *with* **DRUMMOND, D. H.,** jt. auth.
SCHMIDT, HERBERT W. (ab.), Hysterical dysphagia: report of case, Feb., 256.
SCHMIER, ADOLPH A., and BURMAN, MICHAEL S. (ab.), Traumatic axial rotation by gear movement of carpal scaphoid and trapezium with subluxation and foreshortening of first metacarpal, March, 390.
SCHNUR, SIDNEY, Diagnostic pneumothorax, Feb., 198.
SCHRIVER, L. H., *with* **MENDELSOHN, S. N.,** jt. auth.
SCHROEDER, HERMANN (ab.), Effect of ultra-violet rays on vitamin C content of milk, Jan., 130.
SCHÜRCH, O., *with* **UEHLINGER, E.,** jt. auth.
SCHWARTZ, CHARLES WADSWORTH (ab.), Meningiomas: roentgenological viewpoint, March, 389.
SCHWARTZ, VIRGIL J. (ab.), Phases of bronchoscopy and esophagoscopy of importance in general practice, Feb., 250.
SCOTT, WENDELL G., and MOORE, SHERWOOD (ab.), Roentgen kymographic studies of aneurysms and mediastinal tumors, March, 377.
SEYFRIED, H., *with* **LUTZ, W.,** jt. auth.
SGALITZER, M. (ab.), Experience with roentgen therapy in epilepsy, April, 505.
SHELLEY, HAROLD J. (ab.), Calcified fecalith in appendix: report of case of acute suppurative appendicitis perforated by calcified fecalith, April, 502.
SIEGLING, JOHN A., and GILLESPIE, JAMES B., Adolescent tibia vara, April, 483.
SIEVERT, ROLF M. (ab.), Dosage units and ionization method, March, 372.
SILBERMANN, JOSEF, Roentgen diagnostic importance of adipose tissue, Jan., 77.
SIMPSON, W. LIKELY (ab.), Laryngocele, May, 632.
SIRE *with* **MARC, H.,** jt. auth.
SITKOWSKI, WACLAW (ab.), Radiological diagnosis of bladder tumors, June, 749.
SKARBY, HANS-GÖSTA (ab.), Diagnosis of extrapleural abscesses, May, 633.
SLOANE, DAVID, *with* **WOLFORT, BENJAMIN,** jt. auth.
SMEREKER, H., *with* **WASSERBURGER, K.,** jt. auth.
SMYRNIOTIS, P. C. (ab.), Several cases of radiography after injection of pitressin: experimental proofs, Jan., 122.
SNEAD, L. O., *with* **HODGES, FRED M.,** jt. auth.
SNELL, ALBERT M. (ab.), Problem of gastroduodenal hemorrhage, May, 636.
SOHVAL, ARTHUR R. (ab.), Hepatic complications in polycythemia vera, April, 511.
SOILAND, ALBERT, Supervoltage (ed.), June, 742.
SOLOWAY, HERMAN A. (ab.), Renal tumors: review of 130 cases, March, 388.
SOSMAN, MERRILL C., *with* **MOREY, JOHN B.,** jt. auth.
SPANGLER, DAVIS (ab), Radiation therapy of fungus infections, March, 375.
SPARKES, J. V. (ab.), Asbestosis, June, 747.
SPRITZER, MARCELI, *with* **BLÜHBAUM, TEOFIL,** jt. auth.
SPROUL, E. E. (ab.), Carcinoma and venous thrombosis: frequency of association of carcinoma in body or tail of pancreas with multiple venous thrombosis, June, 752.
STEHR, LUDWIG (ab.), Diagnosis of diseases of accessory nasal sinuses by roentgen study, March, 385.
STEINBERG, CHARLES LEROY (ab.), Massive doses of vitamin D in chronic arthritis: effect on calcium metabolism, March, 366.
STENSTRÖM, BO (ab.), Tumors of upper pole of stomach, Jan., 129.
STEVENSON, C. A., Use of roentgen therapy in carotid sinus syndrome, Feb., 209.
STEWART, DUDLEY MARCUS (ab.), Roentgenological manifestations in bone syphilis, April, 518.
STEWART, HAROLD J., CRANE, NORMAN F., and DEITRICK, JOHN E. (ab.), Studies of circulation in pericardial effusion, March, 373.
STONE, HARVEY B. (ab.), Rectal symptoms from general surgeon's standpoint, May, 642.
STOUT, ARTHUR PURDY (ab.), Leiomyoma of oral cavity, March, 387.
STRAUB, M., *with* **den HOED, D.,** jt. auth.
STRAYER, J. W. (ab.), Tuberculous pneumonia, March, 382.
STRICKLER, ALBERT, *with* **GERSHON-COHEN, J.,** jt. auth.
SUBY, HOWARD I., *with* **HOWARD, HERBERT H.,** jt. auth.
SUGIURA, KANEMATSU, and COHEN, IRVING, Further study on direct and indirect actions of radiation on malignant cells: I.—Transplantation of tissue cultures of Mouse Sarcoma 180 after exposure to roentgen rays. II.—Cultures of tumors irradiated *in vivo*, Jan., 71.
SUSSMAN, MARCY L., Leopold Jaches, April, 493.
Idem (ab.), Non-putrid pulmonary suppuration, May, 633.
SUSSMAN, MARCY L., and WOODRUFF, MARSTON T. (ab.), Significance of left auricular dilatation in auricular fibrillation, March, 373.
SUTHERLAND, CHARLES G. (ab.), Value of x-ray in general practice, May, 646.
SUTHERLAND, CHARLES G., *with* **GHORMLEY, RALPH K.,** jt. auth.
SUTHERLAND, CHARLES L. (ab.), Factors which determine diagnosis of silicosis, May, 643.

TANGUY, R. O. (ab.), Os centrale of wrist, March, 390.
TANIS, H. E., Jr., *with* **KINGDON, K. H.,** jt. auth.
TEALL, C. G. (ab.), Deformities of hip joint in children, March, 374.
TERRACOL, J., LAMARQUE, P., and BÉTOULIÈRES, PIERRE (ab.), Peptic ulcer of esophagus, Jan., 121.
THOMPSON, FRED (ab.), Sacro-iliac tuberculosis. March, 387.
THORÆUS, R. (ab.), Five years' experience of modern shock-proof and ray-proof containers for roentgen therapy tubes, Feb., 247.
TILLIER, H. (ab.), Duodenal anomaly, Feb., 258.
Idem (ab.), Reduction of fractures under roentgenoscopic control: two instructive examples, March, 372.
TILLIER, H., *with* **RAYNAUD, R.,** jt. auth.
TIMOFÉEFF-RESSOVSKY, N. W., *with* **ZIMMER, K. G.,** jt. auth.
TIZON, A., *with* **BRAULT, P.,** jt. auth.
TORTAT *with* **GUILBERT,** jt. auth.
TOUROFF, ARTHUR S. W., *with* **NEUHOFF, HAROLD,** jt. auth.
TRUEBLOOD, HAROLD C., and LOUGHRIDGE, DONALD H. (ab.), Scattering and photo-electric absorption of high voltage x-rays in nitrogen, May, 637.
TURNER, PHILIP (ab.), Acute infective osteomyelitis of spine, Jan., 124.
TYSON, RALPH M. (ab.), Certain significant aspects of childhood tuberculosis, Jan., 127.

UDAONDO, C. BONORINO, FINOCHIETTO, E., and MOSTO, D. (ab.), True fibroma of stomach, May, 647.
UDE, WALTER H., URNER, J. A., and ROBBINS, O. F. (ab.), Roentgenologic diagnosis of placenta previa: indirect placentography, June, 749.
UEHLINGER, E., and SCHÜRCH, O. (ab.), Experimental production of sarcoma with radium and mesothorium, March, 383.
ULLMANN, HENRY JOHNSON (ab.), Radiation therapy in acute and chronic inflammatory conditions, May, 631.
UNGERMAN, A. H., VICARY, W. H., and ELDRIDGE, W. W. (ab.), Luetic osteitis simulating malignant disease, April, 517.
URNER, J. A., *with* **UDE, WALTER H.,** jt. auth.

VAN HOVE, VAN de PUTTE, *with* **DAELS, F.,** jt. auth.
VASSELLE, P. (ab.), Two cases of gastric cancer: difficulty of radio-diagnosis of lesions of pyloric antrum, March, 369.
VIALLET, CH., *with* **BERNASCONI, FR.,** jt. auth.
VICARY, W. H., *with* **UNGERMAN, A. H.,** jt. auth.
VIEL, A., *with* **BRILLOUET,** jt. auth.

WALKER, EXUM B., *with* **FINCHER, EDGAR F.,** jt. auth.
WALKER, MAURICE A., and ALLEN, LEWIS G. (ab.), X-ray treatment of erysipeloid, May, 644.
WALTHER, O. (ab.), Results of radiation therapy in sarcomas, May, 643.
WARFIELD, C. H., *with* **HELLWIG, C. A.,** jt. auth.
WASSERBURGER, K., and SMEREKER, H. (ab.), Radium therapy of carcinoma of cervix, Jan., 122.

WEGELIUS, CARL (ab.), Differences between radiological and anatomical measurements, Jan., 123.
WEIGEL, LOUIS (ab.), Diagnostic value of pulmonary radiography in primary tuberculous angina: insufficiency of radioscopy, May, 633.
Idem (ab.), Insufflation of colon as method of diagnosis in gastrocolic fistula following post-operative jejunal peptic ulcer, May, 637.
WEINSTEIN, M. L., and ROVNER, LEOPOLD (ab.), Geiger-Müller counter: recent instrument in medicine and medical research, April, 501.
von **WEISER, W.** (ab.), Fundamental principles of roentgen therapy of inflammatory conditions, Feb., 259.
Idem (ab.), Roentgen therapy of epilepsy, April, 505.
WEISMAN, S. A. (ab.), Correlation of positive reaction to tuberculin and shape of chest, April, 519.
WEISSIG, H. (ab.), Roentgen therapy of diseases of Waldeyer's ring in children, March, 387.
WESTERMARK, NILS (ab.), Bronchostenosis: roentgenological study, June, 750.
Idem (ab.), Roentgen diagnosis of lung embolism, May, 634.
WESTERMARK, NILS, and FORSSMAN, GÖSTA (ab.), Roentgen diagnosis of tuberculous spondylitis, May, 644.
WHARTON, LAWRENCE R., GRAY, LAMAN A., and GUILD, HARRIET G. (ab.), Late effects of acute pyelitis in girls, April, 507.
WHEELER, DIGBY (ab.), Diverticulum of duodenum, Feb., 255.
WHITE, F. D., *with* **CAMERON, A. T.,** jt. auth.
WIDMANN, BERNARD P., OSTRUM, HERMAN W., and MILLER RUSSEL F., Unusual manifestations of bone tuberculosis, April, 434.
WILDMAN, STANLEY F. (ab.), Low back pain in relation to urology, June, 748.
WILLEMIN, F., and CANTAGRILL, M. (ab.), Anomalies of vertebral articular apophyses, April, 517.
WILSON, ROBERT R., and KAMEN, MARTIN D. (ab.), Internal targets in cyclotron, June, 747.
WINDEYER, B. (ab.), Radiotherapy in non-malignant uterine hemorrhage, May, 631.
WINSBURY-WHITE, H. P. (ab.), Brief review of 426 consecutive cases of urinary calculus, Feb., 251.
WISHART, D. E. S. (ab.), Some observations on petrous tip suppuration: report of three cases, Feb., 256.
WITASSE *with* **RONNEAUX, G.,** jt. auth.
WOLFORT, BENJAMIN, and SLOANE, DAVID (ab.), Adamantinoma of tibia, March, 389.
WOLMAN, IRVING J., *with* **BROMER, RALPH S.,** jt. auth.
WOOD, FRANKLIN G. (ab.), Value of radiology in elucidation of hemoptysis, March, 378.
WOODRUFF, MARSTON T., *with* **SUSSMAN, MARCY L.,** jt. auth.

ZACHRISSON, CARL-GUSTAV (ab.), Comparative study of radiograms and anatomical sections of temporal bone, Jan., 123.
ZIMMER (ab.), New Siemens body cavity x-ray tube with pointed anode, Feb., 247.
ZIMMER, K. G. (ab.), Dosimetric and radiobiologic experiments with fast neutrons—I, April, 504.
ZIMMER, K. G., and TIMOFÉEFF-RESSOVSKY, N. W. (ab.), Dosimetric and radiobiologic experiments with fast neutrons—II, April, 504.
ZIMMER, T. (ab.), Distribution of dose in near-distance x-ray tubes and body cavity tubes of various constructions, June, 747.
ZINTHEO, CLARENCE J., Jr., Ceiling-mounted tube rail for general diagnostic x-ray laboratory, April, 477.
ZOLLNER, S., *with* **BARTSCH, H.,** jt. auth.
ZORZOLI, GIUSEPPE (ab.), Bronchographic observation of re-expanded lungs following artificial pneumothorax, May, 638.

RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

VOL. 32 JANUARY, 1939 NO. 1

LIPOID PNEUMONIA IN INFANTS AND CHILDREN[1]

By RALPH S. BROMER, M.D., *and* IRVING J. WOLMAN, M.D., *Philadelphia*

From the Children's Hospital of Philadelphia and the Department of Pediatrics, University of Pennsylvania

LIPOID pneumonia which follows the entrance of oily substances into the lungs is now recognized as a disease entity. The present paper is based on an analysis of 27 cases observed at the Children's Hospital. Twelve of these were found in a series of 137 consecutive autopsies. Other reports give the statistical incidence of this not uncommon condition as follows: Pinkerton (1), six cases in 290 autopsies; Laughlen (2), one case in 300 autopsies; Ikeda (3), seven in 101 autopsies. Goodwin (4) found 25 cases in a period of ten years at the Harriet Lane Home.

Laughlen (1925) is generally acknowledged as the first to report and describe the effects of aspiration of oily substances into the lungs. He reported three cases in children following the naso-pharyngeal installation of liquid petrolatum. On pathologic examination, the alveoli were found to contain large quantities of oil, some of which lay free in the alveoli although the greater portion was located within large mononuclear cells. Cuboidal epithelium replaced the usual epithelial lining of the alveoli, similar to the change often found in atelectasis. Later Thomas and Jewett (5) recorded a case of pneumonia following the aspiration of a large quantity of cream. Pinkerton (1) described six cases of lipoid aspiration causing inflammation of the lung. The cases varied in the type of oil aspirated, likewise in the length of time the oily substances had been in the lungs. He was able, because of the latter, to recognize three stages of the disease. The first corresponds to Laughlen's (2) findings; the second was a stage of interstitial fibrosis; the third, practically an end-result, showed a firm nodular fibrosis of the lungs. He noted also, that the mild vegetable oils, such as poppy-seed, olive, and sesame oil, caused the least reaction, while cod-liver oil, lard, and other animal fats caused a sudden and violent reaction in the lungs with hemorrhage and necrosis. When liquid petrolatum was aspirated, proliferative pneumonia followed. He confirmed Laughlen's findings of the frequent association in the lung of infection with lipoid pneumonia.

The roentgenograms of Pinkerton's (1) cases showed nothing which could be called characteristic of the condition. Goodwin (4), Ikeda (3), and Pierson (6) described in more detail the roentgenographic findings. The latter in his conclusion stated that the presence of fatty material in the lungs produces a very interesting roentgen picture dependent upon the phase

[1] Presented before the Fifth International Congress of Radiology, in Chicago, Sept. 13–17, 1937.

of the disease at the time of examination. He could establish, however, no pathognomonic signs and hoped that his study in order to ensure earlier and more accurate diagnosis. The clinical diagnosis in the remaining seven patients was based

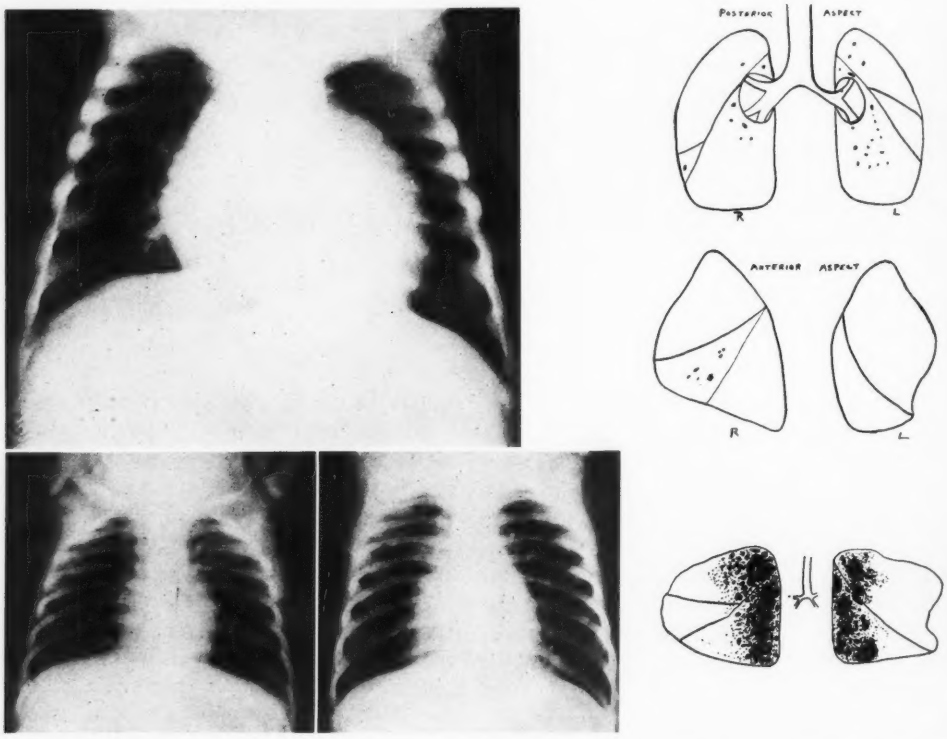


Fig. 1 (*above*). Age, 17 months. Severe rickets. The small scattered dense areas spreading in all directions from the right hilum are due to lipoid deposits in small amount. Shadows such as these are also caused by atelectasis accompanying rickets. Diagrams in this and succeeding illustrations were drawn from postmortem specimens.

Fig. 2 (*below*). Age, five months. Moderate involvement. Roentgenographic changes confined mostly to the right side, in films exposed five weeks apart. Deposits of oil also present in the left lung at autopsy are hidden by the shadow of the heart in these anteroposterior roentgenograms.

might stimulate roentgenologists to make further observations which might aid in the roentgen diagnosis.

This series of 27 cases of lipoid pneumonia in the Children's Hospital was studied especially from the standpoint of roentgen diagnosis. Of the 27 patients, 22 died, and 20 of that number were autopsied. In but one of these 20 cases had the nature of the lung lesion been recognized, although 16 had had roentgen examinations of the chest. This failure of recognition stimulated further and more careful study of the perihilar lung regions on the history, the physical examination, and the well marked roentgenographic findings.

All but four of the children were less than two years of age when first observed, the majority being under one year. In two-thirds of the cases in this series the pneumonia was associated with some sort of constitutional debility, such as prematurity, rickets, congenital syphilis, microcephaly, infantile scurvy, mongolism, spastic diplegia, amyotonia congenita, intestinal malformations, and congenital cardiac defects. This high proportion indicates that

physical weakness must be considered as an important predisposing factor in the etiology of lipoid pneumonia.

The distribution of the lung lesions at necropsy indicated clearly the exogenous origin of the lipoid. The posterior de-

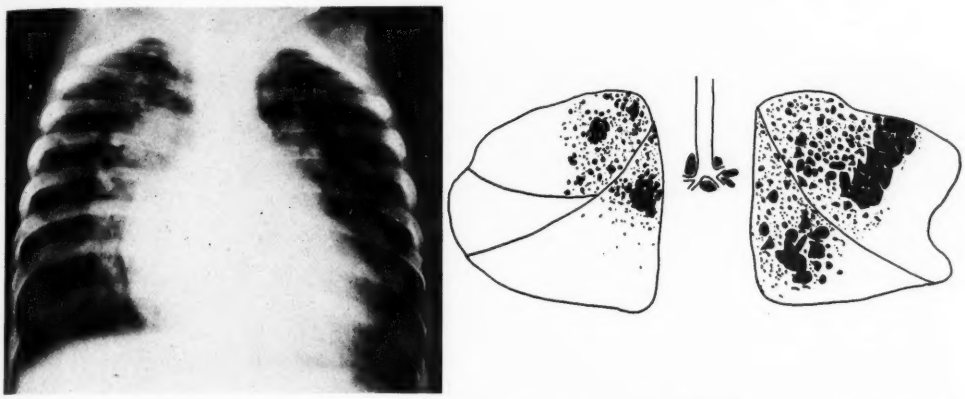


Fig. 3. Age, nine months. Congenital heart disease. Moderate oily perihilar deposits. In this type of case, changes due to passive congestion, anomalous hilar vessels, bronchopneumonia, etc., must be differentiated. Autopsy diagnosis: transposition of great vessels with a patent interventricular septum.

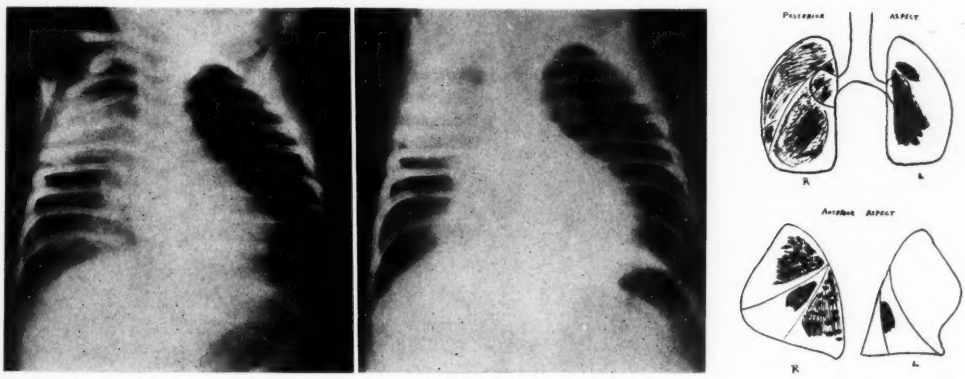


Fig. 4. Age, six weeks. Severe involvement of the right upper lobe. At autopsy this density was found to be due to extensive oil deposits and not due to a coincident pneumonia. Time interval between roentgenograms, two weeks.

It was found that 21 of these patients had retardation of growth and poor nutrition, attributable in most instances to the constitutional disturbance, rather than to the pneumonia. The most common single symptom was chronic cough, present in six patients. As a rule the chest on physical examination seemed clear, although in a few instances minor signs were observed over the consolidated areas. None of the patients had a positive tuberculin test.

pendent portions of the lungs, and especially the perihilar regions, were always affected. The right lung was more involved than the left, possibly because of the straighter course of its main bronchus. The nodules and solid lobules of lipoid pneumonia were confluent, grouped, or widely separated. This is a distinguishing feature in differentiating from xanthomatosis, in which condition the aggregations of lipoid-containing cells are scattered

uniformly throughout all portions of the lobes. Bands of scar tissue were sometimes present. The bronchopulmonary nodes were involved in a few instances.

The nature of the aspirated oil is usually not definitely known. The offending substance seemed to be cod-liver oil in most cases, although a few of the infants had been receiving petrolatum nose drops for varying periods of time. Further studies on identification of the oils within the lungs will be published in the near future.

Roentgenological Considerations.—While Pierson (6) found that the roentgen appearance of his cases was not sufficiently characteristic to establish criteria for definite recognition of the condition, Ikeda (3) felt that with the aid of an accurate clinical history and of roentgenograms of the chest, the diagnosis might be attempted. According to his analysis there is usually a bilateral, irregular, dense, and wide shadow along the pulmonary roots which extends into the perihilar zone and sometimes into the field beyond. In the field, the shadows are sometimes soft, mottled, or feathery and often sharply demarcated from the uninvolved parenchyma. This appearance may remain unchanged for an extended period. The process is only slowly progressive, suggesting a chronic, low-grade productive lesion. The density and persistence of the shadow, the location of the lesion, its tendency to become circumscribed, and its slow process, he considers a fairly typical appearance.

The roentgenograms of this series, some showing a wide distribution, others an extremely slight involvement, emphasize the marked variations in the roentgen picture. It is impossible to differentiate roentgenographic stages which correspond to the pathologic stages of the disease as described by Pinkerton (1). However, the

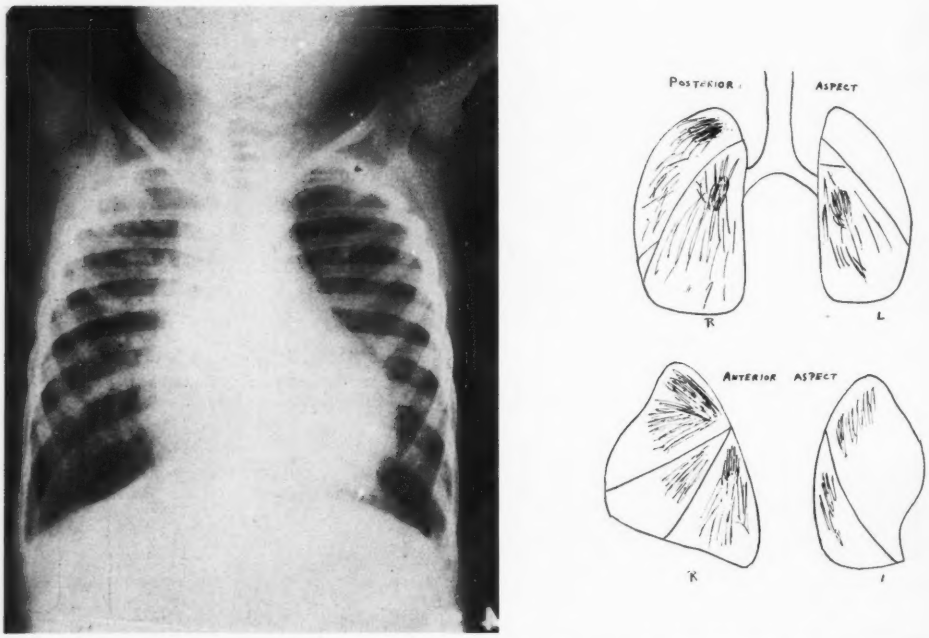


Fig. 5. Age, three years. Autopsy revealed much scarring of the lung with oily deposits. An unusual roentgenographic type of lipoid deposition. The lung changes are strand-like in character and uniformly distributed throughout both lungs.

pulmonary lesions can be classified as mild, moderate, or severe, according to the extent of the involvement. This division is not dependent upon the time that has elapsed following the aspiration

sidual foci, whereas mineral oil produces a more chronic reaction which should result in an unchanged appearance in the serial roentgenograms. Such differentiation could not be made in the roentgenograms

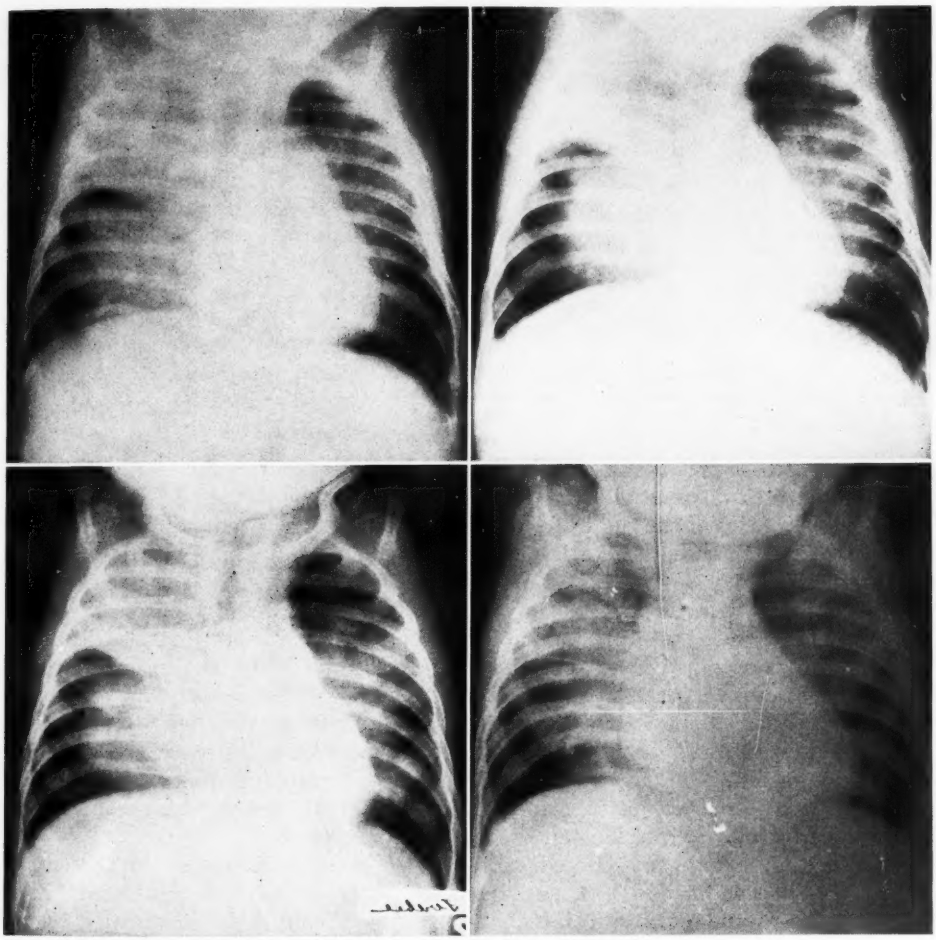


Fig. 6. Severe involvement. Clinical and roentgenographic diagnosis only. Time interval between first and fourth roentgenograms, eight and one-half months. The dense consolidation in the right upper lobe partially cleared, but the persistent densities demonstrate the chronicity of the process.

of the oily substance nor upon the kind of oil aspirated.

Experimental production of lipoid pneumonia as reported in the literature suggests that cod-liver oil causes an acute pneumonia which, after subsiding, leaves re-

of this series. The extent of involvement depends upon the quantity of oil in the lung, regardless of whether it is aspirated in a single large amount or in repeated small quantities.

The roentgenograms of the patients hav-

ing only a mild involvement show an increase both in degree of density and in extent of the hilar shadows. The linear markings of the lung-fields are more exaggerated than normal. There may be is toward the posterior pleura. In the lateral view such extension is difficult to recognize. A definite lobar pneumonia shadow is not seen unless non-lipoid pneumonia is present simultaneously.

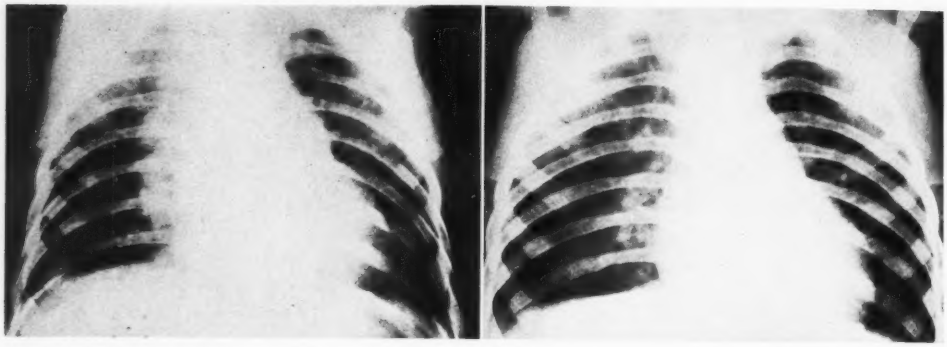


Fig. 7. These roentgenograms are the first and most recent of a serial study extending over a period of 12 months. Note the slow, but incomplete disappearance of the dense oily deposits.

scattered areas of increased density of very small size situated usually along the descending branches of the right bronchus. The heart shadow obscures the left hilar markings.

In the group with moderate involvement there is greater density of the perihilar shadows with widening in all directions. The dense shadows spread more or less homogeneously in all directions from the hilum. In several cases the left lung was entirely unaffected.

In the severe cases, the picture appears as described previously by Pierson (6) and Ikeda (3), and can be considered most typical of the condition. The perihilar shadows spread well out toward the peripheries of the lungs although usually a clear zone is left between the dense shadow and the chest walls. As the child grows this clear zone becomes wider unless the aspiration of oil continues. The edges of the lesions are either sharply demarcated or feathery. The oily deposit may extend up to the pleura, in which case the dense area extends to the chest wall. This is not often present in anteroposterior projections since the direction of involvement

In this series coincident inflammation of the lungs was found frequently at necropsy as had been pointed out also by Laughlen (2). This may develop in the mild, moderate, or severe cases. Serial examinations are very necessary to recognize its development and also to establish the chronicity of the process when no pneumonia supervenes. The positive diagnoses made in the five patients in this series who are still living were based on the roentgenographic findings, typical of severe involvement, and proven chronic by serial roentgenograms.

Differential Diagnosis.—In patients having only a mild involvement, definite diagnosis cannot be made with certainty unless the history of oil aspiration is very accurate, with such details as choking on attempts to feed cod-liver oil, etc. In both the mild and the moderate cases, as suggested by Ikeda (3), there may be a resemblance to the "broncho-sinusitis" of Wasson, due to chronic non-tuberculous lung infection secondary to some focus in the upper respiratory tract. Age incidence is a differential point. If a child is not examined after a development of

coincident pneumonia, the previous lipoid involvement may easily be overlooked.

Tuberculosis can be excluded by the negative tuberculin reaction, the lack of enlarged or calcified tracheobronchial nodes, and the complete absence of shadows suggestive of cavity.

When rickets predisposes to lipoid aspiration, the small areas of rachitic atelectasis may resemble superficially deposits of lipoid. However, the "atelectatic strips" of rickets, quite different from the perihilar shadows of lipoid pneumonia, extend upward and downward from the hilar regions in their own characteristic fashion. When a congenital cardiac defect is present, the perihilar shadows of lipoid pneumonia must be differentiated from hilar changes due to passive congestion, anomalous hilar vessels, etc. This may be impossible and dependence must be placed upon an accurate history of oil aspiration before a diagnosis of lipoid pneumonia may be ventured.

CONCLUSIONS

Pneumonia due to the aspiration of oily substances is not uncommon and can be considered a clinical and pathologic entity.

Infants with physical debility and neurologic disorders seem to be unusually susceptible.

The roentgen diagnosis can be made in patients having extensive involvement. It is based upon location of lesions in the perihilar regions, in the posterior portions of the lungs, and to a greater degree in the right lung than in the left. In the moderate and mild cases, serial roentgenograms and an accurate history are needed before a positive diagnosis can be attempted. The necessity for serial examinations cannot be emphasized too strongly.

It is not wise to employ liquid petrolatum, etc., as nose drops in any small, weak, or debilitated child. When infants are inclined to vomit oil it is important that they be placed on the side or abdomen rather than upon the back. Cod-liver oil or liquid petrolatum should never be forced.

REFERENCES

(1) PINKERTON, HENRY: Oils and Fats: Their Entrance into and Fate in the Lungs of Infants and Children: A Clinical and Pathological Report. Am. Jour. Dis. Child., **33,** 259–285, 1927.

(2) LAUGHLEN, G. F.: Pneumonia Following Nasopharyngeal Injections of Oils. Am. Jour. Path., **1,** 407–414, July, 1925.

(3) IKEDA, KANO: Oil Aspiration Pneumonia (Lipoid Pneumonia): Clinical, Pathologic, and Experimental Considerations. Am. Jour. Dis. Child., **49,** 985–1006, April, 1935.

(4) GOODWIN, T. CAMPBELL: Lipoid Cell Pneumonia. Am. Jour. Dis. Child., **48,** 309–326, August, 1934.

(5) THOMAS, W. S., and JEWETT, C. H.: Pneumonia Following the Aspiration of Fats from the Esophagus Dilated as a Result of Cardiospasm. Clifton Med. Bull., **12,** 130, 1926. (Quoted by Goodwin, ref. 4.)

(6) PIERSON, J. W.: Some Unusual Pneumonias Associated with the Aspiration of Fats and Oils in the Lungs. Am. Jour. Roentgenol. and Rad. Ther., **27,** 572–579, April, 1932.

BRONCHOGENIC CARCINOMA

A STUDY OF EIGHT AUTOPSIED CASES

By WILLIAM E. HOWES, M.D., Attending Radiation Therapist, *and* SAMUEL GEORGE SCHENCK, M.D., Associate Radiation Therapist, *Brooklyn, New York*

From the Brooklyn Cancer Institute, Department of Hospitals, City of New York; Ira I. Kaplan, M.D., Director

DURING the year 1937, the Brooklyn Cancer Institute had 737 new admissions. Among these new patients there were 17 proved cases of bronchogenic carcinoma, 12 of whom died. Eight of these fatal cases of primary carcinoma of the lung were necropsied. It is the purpose of this presentation to report the clinico-pathologic features of these eight patients who were submitted to a post-mortem examination.

Incidence.—Of the 737 new cases admitted to the Institute during 1937, 582 were proved to be malignant, including the 17 patients with bronchus carcinoma. This reveals an incidence of slightly less than 3 per cent. In larger series of cases, bronchogenic carcinoma shows an incidence as high as 10 per cent of all cancers (1).

Etiology.—The cause is still unknown, but it is generally conceded that some form of chronic pulmonary irritation accounts for the development of the neoplasm in most of the patients. The irritant may act by virtue of a mechanical effect, such as trauma, dust, etc.; chemically, such as tar fractions from roads or employment, tobacco smoke, war gases, motor exhaust fumes; bacterial influences, such as influenza, tuberculosis, fungi, and other chronic pulmonary diseases; radio-active inhalants, affecting miners in the uranium ores of Schneeberg and Joachimstal where the incidence of lung cancer is high, and, possibly, thermal effects, as in modern industries.

If heredity plays a rôle in the production of lung cancer, it probably requires some irritant to stimulate the growth of an embryonal rest. Congenital malformations or developmental anomalies are rarely observed in these patients, but have been reported (2).

In our series there have been no developmental malformations in the bronchi or lungs. Pulmonary tuberculosis as an etiologic factor has been considered and discarded (3). One case (Case 1) showed a co-existent tuberculous infection involving the right apex which was healed. None in our group gave a history of trauma or injury to the chest wall, such as is occasionally reported (4) as the immediate etiologic agent. Our cases also fail to offer in the history or occupation any suggestion that might point to a possible cause for the development of the lesion.

Clinical Features.—There were seven males and one female. All were white except for one negro. In larger series the ratio of males to females is four to one. Their ages ranged from 39 to 66 years, the average being slightly over 49. Cough was the most prominent symptom (occurring in seven of the eight cases). Expectoration and loss of weight were present in six patients, and pains in the chest (or shoulders) and weakness in four. Hemoptysis, shortness of breath, and fever occurred in three. Among the rarer symptoms were night sweat and hoarseness, each of which occurred in two patients. In one of these two cases aphonia was the chief symptom (Case 6). In four patients (Cases 4, 5, 6, 7), the main complaints were caused by the metastatic involvement, the patient either suffering from the pain (Cases 4 and 7) or being cognizant of a mass or swelling (Cases 5 and 6).

The physical signs pointed to a lesion in the chest in six of the eight patients,

although the exact nature of the pathology was by no means disclosed. Pleural fluid was present in three cases, in one of which (Case 7) the sediment yielded findings sufficient to warrant a diagnosis of epithelial malignancy. One patient showed marked clubbing of the fingers (Case 2).

In five of the eight patients the lesion involved the right lung. In four, the right upper lobe was affected; in one, the right lower, and in three, the upper lobe of the left lung.

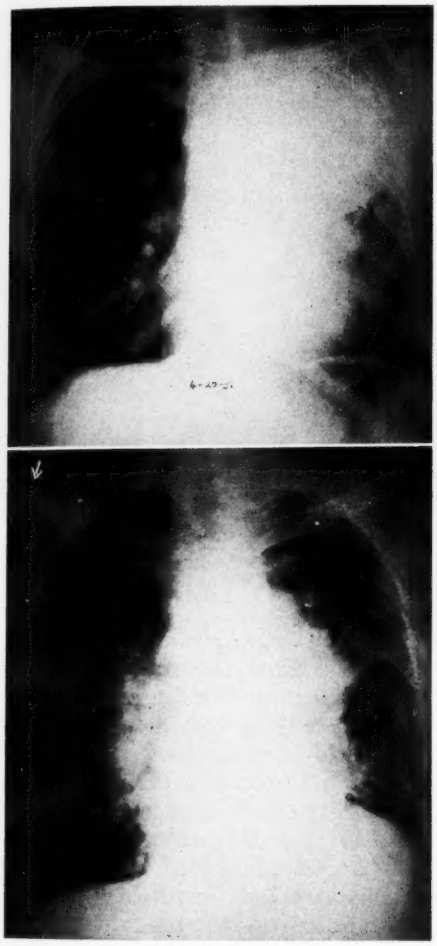


Fig. 1 (*above*). Case 5. Roentgenogram suggested a neoplasm or a fluid cyst of the lung. Because of the globular mass in the left anterior chest (cf. Fig. 14) and the positive Wassermann, aortic aneurysm had to be excluded. Autopsy disclosed a bronchogenic carcinoma of left upper lobe.

Fig. 2 (*below*). Case 6. Pronounced bilateral hilar density with marked peribronchial thickening extending peripherally. Left leaf of diaphragm elevated. Area of rarefaction in right clavicle (arrow), probably metastatic. Diagnosis of lymphoblastoma was ventured. Autopsy showed a bronchogenic carcinoma of left upper secondary bronchus with a metastatic focus in the right clavicle.

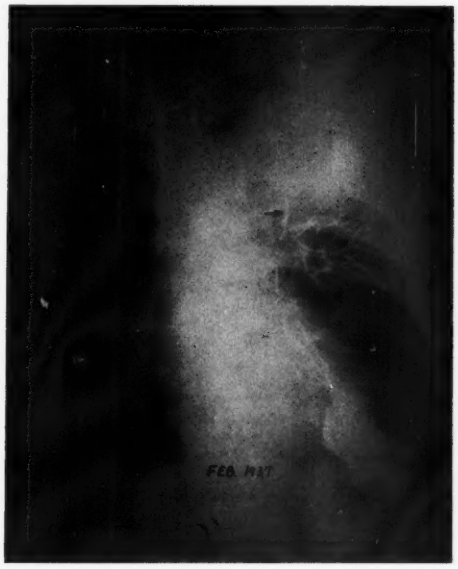


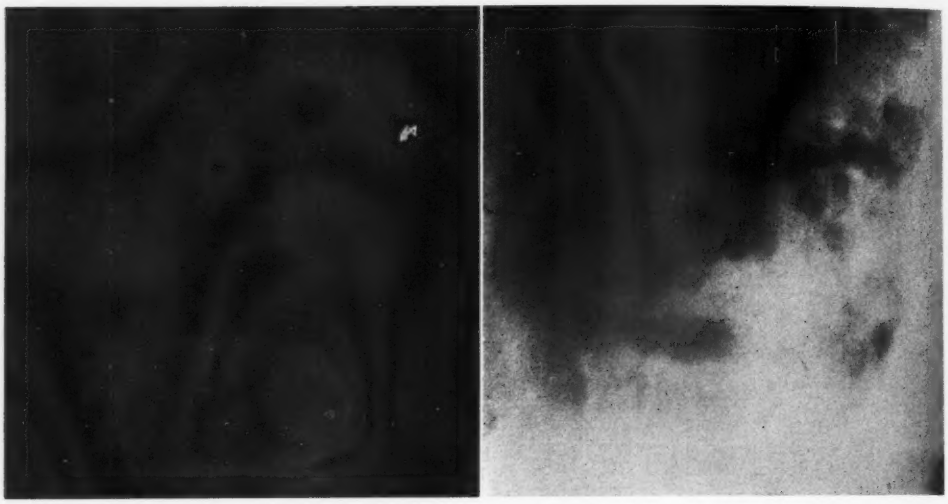
Fig. 3. Case 3. Passive bronchography showing stenosis of left upper bronchus (arrow) due to neoplasm. Same case as shown in Figures 6, 7, and 12.

Diagnosis.—The recognition of bronchogenic carcinoma is probably most dependent upon the roentgenographic study. The symptoms and physical signs are too indefinite and may point to many other intrathoracic conditions. Roentgenology including bronchography (and occasionally abetted by an induced pneumothorax) should render the diagnosis highly probable. In recent years planigraphy has aided in visualizing the growth and the possible presence of cavities. In the presence of pleural fluid, an over-penetrated film or, better yet, a Potter-Bucky exposure, particularly after thoracentesis, may reveal the status of the underlying lung. The aspirated fluid, which is often

sero-sanguinous in nature, may disclose suspicious malignant cells. Biopsy of an enlarged lymph node should also not be overlooked (Case 7). Every suspected patient is entitled to a bronchoscopic examination, although negative findings here, as in so many other procedures in medicine, do not exclude the possibility of a bronchial newgrowth, particularly when the suspected lesion lies in the upper lobes or involves one of the smaller bronchi or bronchioles.

The roentgenograms, including bronchographic visualizations, were fairly diagnostic in five of the eight cases. In Case 1, the massive amount of fluid prevented a view of the underlying lung. In Case 5, the roentgenologic interpretation was that of a neoplasm or fluid-containing cyst (Fig. 1). In the other diagnostic failure, the diagnosis of a lymphoblastoma (Fig. 2) was ventured (Case 6). Radiographically bronchial neoplasm is revealed as a hilar growth or a peripheral tumor. Atelectatic changes involving a whole lobe or a part of it are usually secondary to the hilar type which obstructs a main bronchus with resultant atelectasis. The instillation of iodized oil, preferably by the passive method, will often demonstrate the occluded bronchus. It is particularly efficacious in the upper lobes (Fig. 3), the bronchi of which are the most difficult to reach with the bronchoscope.

In six of the eight patients bronchoscopy



Figs. 4-*A* and 4-*B*. Case 4. Destruction of the body of the first lumbar vertebra due to metastasis from a bronchogenic carcinoma. Backache was the patient's chief complaint. (*A*, anteroposterior; *B*, lateral view.)

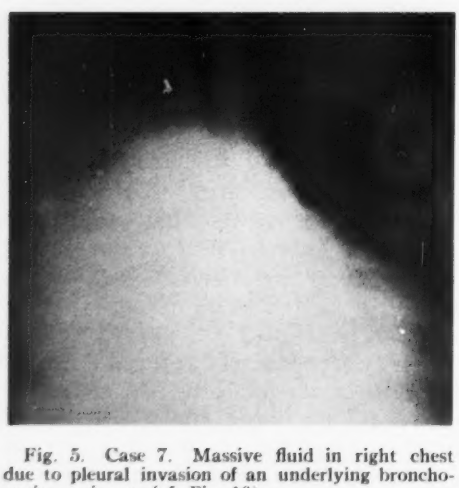


Fig. 5. Case 7. Massive fluid in right chest due to pleural invasion of an underlying bronchogenic carcinoma (cf. Fig. 16).

was performed and in each instance the results were negative or unsatisfactory. In two cases (Cases 3 and 8) thoracotomy and exploration were performed. In one (Case 3) the growth was found to be too in its central portion due to a diminishing blood supply as it spreads peripherally, and simulate the roentgen findings of a simple pulmonary abscess or multiple abscesses.

Fig. 6.

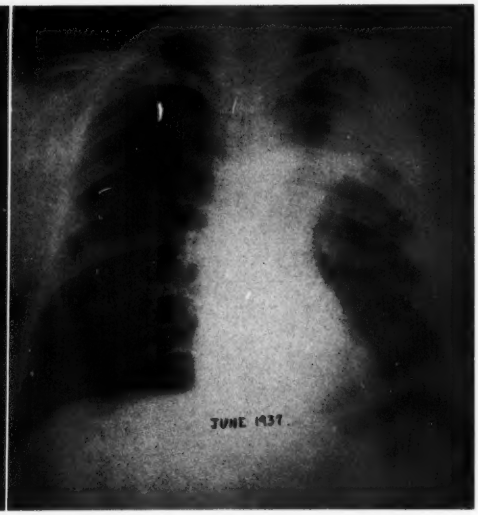


Fig. 7.

Fig. 6. Case 3. Bronchogenic carcinoma (left upper), before high voltage roentgen therapy. Same case as shown in Figures 3 and 7.

Fig. 7. Case 3. Bronchogenic carcinoma (left upper), after roentgen therapy. Pronounced clinical and roentgenographic improvement. Same case as shown in Figures 3 and 6, before treatment.

extensive for removal, showing invasion of the mediastinal nodes. In the second case, the patient expired of circulatory collapse after lobectomy.

Carcinoma of the lung must sometimes be differentiated from chronic pulmonary disease, particularly pulmonary tuberculosis and lung abscess, and, occasionally, from atypical forms of pulmonary infarction, pleuritis, lymphoblastoma, and a fluid cyst. Case 5 was treated for several weeks at another institution for pulmonary tuberculosis because of a history of night sweats, weakness, loss of weight, cough and blood-stained sputum, and an infiltrating shadow in the apex of the left lung. In Case 2 a tentative diagnosis of a lung abscess was proferred because of the necrotizing appearance of the dense shadow in the right lower lobe. A bronchial neoplasm may not infrequently excavate

Metastasis.—Occasionally, the metastatic involvement overshadows the existence of the primary growth in the lung so that the patient's symptoms are referable mainly to the secondary deposits. In Case 4, the pain in the back was the patient's chief complaint, cough and expectoration being inconsequential in degree (Fig. 4). Cases 5 and 6 were similarly affected, the metastasis obscuring the true nature of the malady.

Clinically, secondary invasion was suspected or recognized in every case but one (Case 8). The brain was suspected in two cases (Cases 1 and 2) by the physical examination and confirmed in each instance by necropsy. Involvement of the pelvis was suspected in three cases (Cases 3, 4, and 7) and showed definite radiologic changes. The spine, ulna, clavicle, rib, and femur were involved in one case each.

One patient (Case 7) gave a positive biopsy from an enlarged inguinal node. Pleural metastasis (Fig. 5) results in fluid, as in three patients in our group (Cases 1, 5, and 7).

Fig. 8. Case 3. Photomicrograph of tissue from adenocarcinoma of the bronchus. Low power.

Course and Treatment.—In our series the shortest duration of the disease from the beginning of symptoms to exitus was five months (Case 4). The longest length of life was 17 months (Case 6): the average duration was 11.7 months. These statistics are comparable with those reported in the literature. The vast majority of patients live less than two years.

Treatment consists of x-ray, radium, or surgery. Although improvement not infrequently follows intensive high voltage therapy which can be demonstrated roentgenologically (Figs. 6 and 7) by a reduction in the size of the tumor (Cases 3 and 6), nevertheless, the mass soon increases in size and eventually the patient succumbs. The technical factors consist of three ports over the involved lung anteriorly, posteriorly, and laterally. Each port is controlled by roentgenoscopy and roentgenography to determine the exact size and location of the skin portals for the purpose of accurately cross-firing the underlying pathology. Daily 200 r are given to each of the three regions for a total of from 3,000 to 4,000 r (in air, without backscattering) to each field, with the following setup: 200 kv.p., 20 ma., 2 mm. copper and 1 mm. aluminum filters, 50 cm. distance.

Fig. 9. Case 3. Metastatic deposits (osteolytic type) in left ischium, acetabulum, and upper femur (arrows) from bronchogenic carcinoma.

With the recent advances in thoracic surgery, lobectomy or pneumonectomy hold promise in early cases in which the lesion lies in the peripheral portion of the lung and the pleura and mediastinum are cancer-free.

Pathology.—Microscopically three types of cells are seen: (1) Squamous cells; (2) adenocarcinoma, and (3) undifferentiated round or spindle cell of the bronchial epithelium. Contrary to other statistics in which the squamous carcinoma predominates, all our patients showed an adenocarcinoma (Fig. 8). However, the number of patients is too small from which to draw any conclusions.

In our group the following metastases were seen in necropsy in the order of their frequency: skeleton (7); mediastinal lymph nodes (5); pleuræ (4); adrenals (4); pancreas (3); lungs (2); liver (2); retroperitoneal nodes (2); pericardium (1); kidneys (1); cervical nodes (1); heart (1); spleen (1); abdominal lymph nodes (1); superior mesenteric vein (1); pulmonary arteries and veins (1); thigh (1); anterior chest wall (1); retroperitoneal nerves (1); diaphragm (1); trachea (1); common bile duct (1), and inguinal nodes (1).

Among the osseous metastases, the pelvis (Fig. 9) was involved in two cases and the spine (lumbar vertebræ), femur, ribs, clavicle, and ulna in one each.

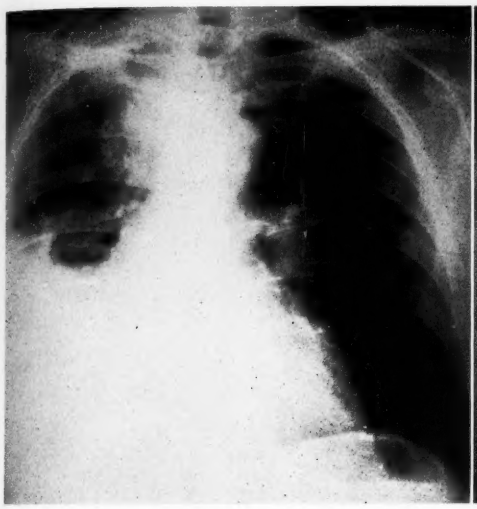


Fig. 10

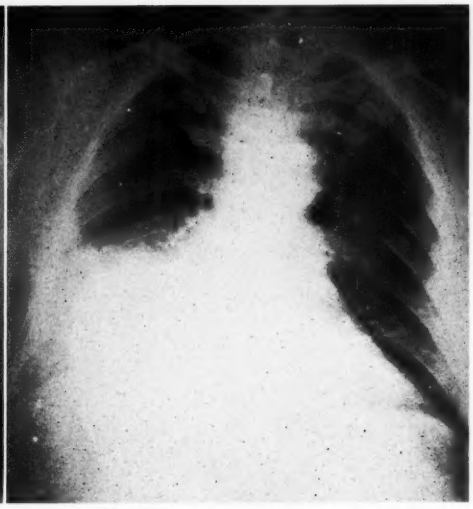


Fig. 11.

Fig. 10. Case 1. Roentgenograms revealed a right superior mediastinal mass and right pleural fluid. Necropsy showed the mediastinal mass to be a bronchogenic carcinoma of the right upper lobe with extension to the thoracic and diaphragmatic pleura with fluid.

Fig. 11. Case 2. Roentgenograms showed a tumefaction in the right lower lung. Autopsy confirmed the roentgen impression of bronchogenic carcinoma of the right lower lobe which also showed areas of necrosis.

REPORT OF CASES

Case 1. A. G., white male, 42 years of age, no occupation. Chief symptoms were pain in the chest and headaches; also cough, expectoration, and slight dyspnea. Physical signs of fluid in right chest. Roentgenograms showed a superior mediastinal mass and right pleural fluid (Fig. 10). Skull negative. Bronchoscopy was negative except for a slightly thickened corina and edema of right lower bronchus. Clinical impression was that of mediastinal tumor. Autopsy[1] revealed bronchogenic carcinoma of upper lobe of right lung with extension to the thoracic and diaphragmatic pleura resulting in fluid, to the retrosternal tissue, to the brain, and to the right adrenal medulla. It also showed a healed right apical pulmonary tuberculosis. The duration of symptoms from the onset to expiration was 14 months.

Case 2. P. V., white male, 53 years of age, no occupation. Patient complained of cough, sputum, pain in the right leg, loss of weight, weakness, fever, and night

[1] The authors are indebted to Dr. H. Bolker, pathologist of the Brooklyn Cancer Institute, for the autopsy findings in all the cases.

sweats. Physically, he showed mental confusion and neurologic signs of focal brain involvement, in addition to signs in the lower chest and clubbing of the fingers. Roentgenograms showed a tumefaction nodes were also involved. He received two cycles of high voltage roentgen therapy through three ports in the chest for a total of 12,000 r for each cycle. Estimated depth (tumor) dose for each cycle was 7,500

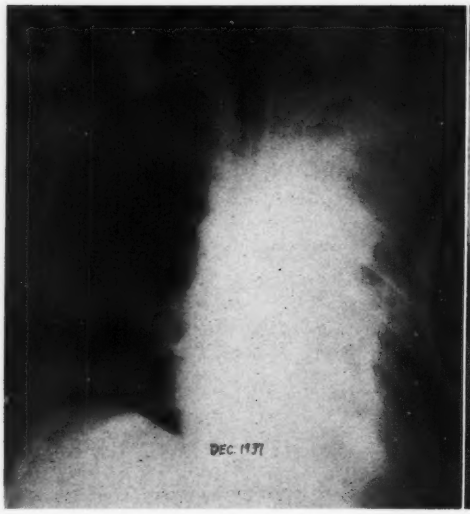


Fig. 12.

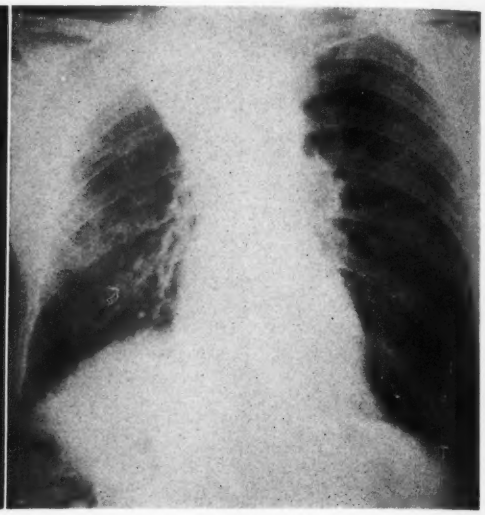


Fig. 13

Fig. 12. Case 3. Marked spread of carcinoma of left upper bronchus, several weeks before exitus. Same case as shown in Figures 3, 6, and 7.

Fig. 13. Case 4. Wedge-shaped area of density in right upper pole. Right leaf of diaphragm elevated. Roentgen diagnosis of primary bronchus carcinoma producing atelectasis was confirmed by necropsy.

in the right lower lung (Fig. 11). Skull and skeletal systems were negative. Necropsy revealed bronchogenic carcinoma of the lower lobe of the right lung with necrosis and extension to the abdominal aortic lymph nodes, head of the pancreas, superior mesenteric vein, cerebrum, cerebellum, and dura. The duration of symptoms in this case was 13 months.

Case 3. J. D., white male, 44 years of age, salesman. Symptoms were bloody sputum, cough, expectoration, emaciation, weakness, fever, and pains in the right shoulder and left leg. Roentgenograms showed a large mass in the left upper lobe with metastasis to the left ischium, acetabulum, and upper femur (Figs. 3, 6, and 9). Bronchoscopy was negative. Upon operation, the lesion was found to be too extensive for removal and the mediastinal r. The pelvis and femur were also treated. Definite clinical and roentgenologic improvement (Fig. 7) followed therapy, lasting for several months (Fig. 12). Autopsy showed a bronchogenic carcinoma of the left upper lobe (Fig. 8) with secondary involvement of the pleura, mediastinal nodes, pericardium, pelvis, and femur. Duration of symptoms was seventeen months.

Case 4. J. R., negro, 66 years of age, barber. Chief symptom was a pain in the lower back. Other symptoms were loss of weight, and cough with expectoration. Lungs were negative on physical examination. Roentgenograms showed destruction of first lumbar vertebra commonly seen with metastatic carcinoma (Fig. 4). The chest (Fig. 13) disclosed a wedge-shaped area of density in the right upper lobe,

with evidence of bronchostenosis of a branch of the upper bronchus after the instillation of lipiodol. Bronchoscopy was negative. Postmortem examination showed bronchogenic carcinoma of right upper lobe with metastasis to the first lumbar vertebra. The total duration of symptoms was five months.

Figs. 14-*A* and 14-*B*. Case 5. Photographs showing the globular mass in the left anterior chest wall, suggesting aneurysm or gumma (cf. Fig. 1). Autopsy disclosed a bronchogenic carcinoma with secondary involvement of the mediastinal nodes and anterior chest wall. (*A*, anterior view; *B*, lateral view.)

Case 5. V. T., white male, 39 years of age, no occupation. Chief complaints were a mass in left anterior chest wall (Fig. 14) and inner posterior aspect of the left thigh. Other symptoms included hoarseness, dyspnea, occasional cough with expectoration and blood-streaked sputum, night sweats, asthenia, emaciation, and fever. He was treated for tuberculosis at another institution. Sputa were repeatedly negative for tubercle bacilli. The blood Wassermann was 4 plus. Biopsy from left inguinal mass suggested the diagnosis of a sarcoma. Roentgenograms showed a spherical mass in the left upper chest (Fig. 1) corresponding to the swelling noted clinically. Subsequently, left pleural fluid developed; also an area of rarefaction in the right ulna (Fig. 15). Bronchoscopy was negative. Clinical impressions were tertiary syphilis with gummas of anterior chest wall and left groin; possible aortic aneurysm; sarcoma. Necropsy disclosed a bronchogenic carcinoma of the left upper lobe with extension into the pulmonary arteries and veins, left auricle, mediastinal and retroperitoneal nodes, right ulna, both adrenals, body of the pancreas, anterior chest wall, left thigh, and retroperitoneal nerves. Total duration of symptoms was seven months.

Case 6. H. B., white male, 56 years of age, blacksmith. Symptoms of hoarseness, lump in the neck, considerable loss of weight, and weakness. Roentgen examination showed bilateral hilar areas of density with marked peribronchial thickening extending peripherally (Fig. 2). Left leaf of

diaphragm was elevated; area of rarefaction in right clavicle, probably metastatic. Bronchoscopy was negative. Clinical diagnosis of lymphoblastoma was made. Biopsy of an enlarged node in the neck was reported as metastatic carcinoma, probably of bronchial origin. Roentgen therapy afforded temporary palliation. Postmortem findings revealed a bronchogenic carcinoma of the left upper secondary bronchus with extension into the left and right pulmonary parenchyma, pleura, diaphragm, mediastinal nodes, areolar tissue, retroperitoneal lymph nodes, cervical glands, trachea, pancreas, liver, common bile duct, left adrenal, right clavicle, and left kidney. Total duration of symptoms was 17 months.

Figs. 15-*A* and 15-*B*. Case 5. Two views of rarefied area in upper ulna due to metastatic involvement from a bronchogenic carcinoma.

Case 7. M. B., white female, 49 years of age, housewife. Symptoms were breathlessness, cough, pains in sacral region radiating down the right thigh and leg, and pain in the chest on coughing. Roentgenograms showed a dense mass occupying the right upper lobe with elevation of the right leaf of the diaphragm, the findings suggesting a primary lung tumor (Fig. 16); increased density and thickening of the right ischium and left os pubis (Fig. 17); area of bone condensation in the right ninth rib. Biopsy of a right inguinal node showed metastatic carcinoma, possibly of bronchial origin. Thoracic fluid (Fig. 5) of a sero-sanguinous nature developed in the right chest necessitating frequent thoracentesis. Examination of the fluid revealed sufficient cells to warrant a diagnosis of epithelial malignancy. Prior to exitus the patient developed the signs of embolism in the popliteal artery of the right leg. The toes and foot became cold, edematous, and discolored. Autopsy showed a bronchogenic adenocarcinoma of the right upper lobe with metastasis to the pleura, right lower lobe and left lung, tracheobronchial nodes, spleen, ribs, right ischium and inguinal nodes (from the ischial lesion), adrenals, and liver. There was also evidence of an infarct of the left ventricle with an organizing intraventricular thrombus and embolization to the kidneys and right popliteal and femoral arteries with gangrene of the foot. The total duration of symptoms was 13 months.

Case 8. V. B., white male, 44 years of age, plasterer. Symptoms of pain in the right side of the chest, hemoptysis, cough, and expectoration. Physically, there were signs of consolidation in the right upper lobe. Roentgenological study showed what appeared to be a primary tumor in the upper right chest (Fig. 18). The roentgenograms of the skeleton were normal. Bronchoscopy was negative. The patient was surgically explored and died of circulatory collapse after an attempt at lobectomy. Necropsy revealed the presence of a bronchogenic carcinoma of the right upper lobe. Duration of symptoms was eight months.

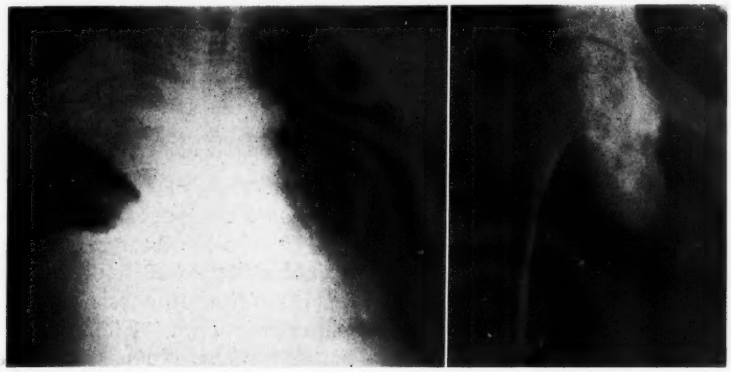


Fig. 16. Fig. 17.

Fig. 16. Case 7. Dense mass in right upper lobe with elevation of right diaphragm, representing a primary lung tumor. Same case as shown in Figure 5.
Fig. 17. Case 7. Increased density and thickening of right ischium representing the osteoblastic type of metastasis from a primary bronchus carcinoma.

Figs. 18-*A* and 18-*B*. Case 8. Roentgen study showed what appeared to be a primary tumor in upper right chest. Confirmed by necropsy. (*A*, postero-anterior view; *B*, lateral projection, showing the triangular shadow suggestive of bronchostenosis.)

SUMMARY

It would be presumptuous to attempt to draw conclusions from our small series of cases. Nevertheless, close scrutiny reveals several striking observations:

(1) The incidence of bronchogenic carcinoma is sufficiently high to demand our most earnest attention and concern.

(2) The etiology is unknown.

(3) The symptoms are not unlike those met with in other chronic pulmonary diseases, especially tuberculosis, bronchiectasis, lung abscess, mediastinal tumor, and fluid cyst of the lung.

(4) The roentgenographic study, including iodized oil instillation, reveals the true nature of the pulmonary pathology in a great majority of the cases.

(5) In the presence of pleural fluid which obscures the underlying lung markings, an attempt to visualize the pulmonary process by over-penetrated films or by Potter-Bucky exposures with or without passive bronchography with lipiodol should be made.

(6) With a mass in the region of the thoracic aorta, kymographic studies are indicated to exclude the possibility of an aneurysm.

(7) A necrotizing process in the lung, portrayed roentgenologically, does not exclude the possibility of a carcinoma which has undergone liquefaction necrosis.

(8) A negative bronchoscopic examination does not preclude the diagnosis of a primary lung tumor, especially when the involvement is in the upper lobes or located in the finer bronchi.

(9) If the diagnosis is in doubt, a biopsy, by excision or aspiration, of an available enlarged lymph node or mass should be made.

(10) A metastatic process may present the first symptom of the disease. In suspecting the lung as the primary seat, any chronic pulmonary process, no matter how small, should be thoroughly investigated before excluding it as a possibility.

(11) Clinically, the skeletal system, regional lymph nodes, and pleuræ are the sites of metastatic predilection. In the osseous system the pelvis, femur, spine, skull, and ribs are the more susceptible regions.

(12) Roentgenologically, the skeletal lesions show osteolytic, osteoblastic, or combined types of involvement.

(13) The prognosis of bronchus carcinoma is bad. The vast majority of patients die within one or two years.

(14) The present recognized forms of treatment are radiation and surgery. Radiation with the present technic is at best palliative; surgery offers hope in selected cases.

(15) Microscopically, three types are recognized—the squamous carcinoma, the adenocarcinoma, and the undifferentiated group.

(16) The more common sites of metastasis shown by necropsy are the regional lymph nodes, bones, pleuræ, adrenals, pancreas, liver, lungs, brain, pericardium, heart, cervical nodes, and kidneys.

152 Clinton Avenue
115 Eastern Parkway

REFERENCES

(1) SIMONS, EDWIN J.: Primary Carcinoma of the Lung. The Year Book Publishers, Chicago, 1937.

(2) SCHWYTER, M.: Über das Zusammentreffen von Tumoren und Missbildungen der Lungen. Frankfurt. Ztschr. f. Path., **36**, 146–172, 1928.

(3) LUBARSCH, O.: Statistics on Mortality and Necropsies. Med. Klin., **10**, 299, 300, March 9, 1924.

(4) AUFRECHT: Traumatic Cancer of Left Lung. Deutsches Arch. f. klin. Med., **144**, 371–374, July, 1924.

SPONTANEOUS MEDIASTINAL EMPHYSEMA

WITH REPORT OF A CASE ASSOCIATED WITH SPONTANEOUS PNEUMOTHORAX

By JOHN B. MOREY, M.D., Commonwealth Fellow in Roentgenology, 1938, *Ada, Oklahoma, and* MERRILL C. SOSMAN, M.D., *Boston, Massachusetts*

From the Department of Roentgenology, Peter Bent Brigham Hospital, Boston, Massachusetts

THE credit for bringing this rare condition to the attention of the medical profession belongs largely to Hamman (3). In 1937 he reported five cases, two of which had a small spontaneous pneumothorax associated with their mediastinal emphysema. The same year Scott (6) reported two cases and called attention to the similarity of the pain of mediastinal emphysema to the angina of coronary thrombosis.

There are a few case reports of this condition in the literature, sometimes occurring alone, and sometimes with pneumothorax as a result of definite causes. Some have occurred during influenza or pneumonia and have been ascribed to rupture of the alveolus during coughing. Faulkner and Wagner (2) reported a case in an uncontrollable asthmatic. A few such cases have occurred following artificial pneumothorax in which air may have been injected directly into lung tissue or in which the air in the pleural cavity escaped through the pleura into the mediastinal space. Trauma to the trachea or to the pleura may cause mediastinal emphysema. It sometimes follows thoracotomy and thyroidectomy. Strains of any kind, such as lifting, straining at stool, crying, paroxysms of coughing, or childbirth may be responsible for the rupture of an alveolus.

From the paucity of case reports of spontaneous mediastinal emphysema in the literature one would be led to believe that the condition is either rare or not well understood. It is an important condition to diagnose not because of its seriousness but because of the seriousness of the conditions it may simulate. As Hamman (3) and Scott (6) have pointed out, mediastinal emphysema must be differentiated from such serious conditions as coronary thrombosis, acute pericarditis, ruptured aneurysm, and pulmonary embolus.

As has been stated, there may be a direct cause or an alveolus may rupture spontaneously. Such ruptures may occur more often than one would think, and be responsible for some of the pains in the chest that occur without apparent cause. After rupture, the air escapes through the rent in the alveolus and dissects its way through the fibrous tissue about the bronchi and blood vessels, escaping into the mediastinum through the hilum of the lung. From thence, if enough accumulates, it may dissect its way up into the neck and over the shoulders. Occasionally, the air from an alveolus will dissect its way to the pleura and escape into the pleural cavity, producing a spontaneous pneumothorax as well as a spontaneous mediastinal emphysema.

The onset of the condition is apt to be sudden and dramatic. The pain strikes the patient suddenly and is often severe in character, being located along the border of the sternum and referred to the shoulder and down the arm. There is an increase in pulse rate and sometimes an elevation of temperature. The patient may be short of breath and actually cyanotic, depending upon whether or not the amount of air in the mediastinum is sufficient to produce collapse of the blood vessels from pressure. Soon after the pain strikes, the patient will often say he can feel or even hear a peculiar knocking or clicking in his chest. This may be associated with the beating of the heart, respiration, and occasionally with swallowing. Change of position will cause a change in the intensity of the noise or perhaps complete disappearance of it.

Examination will show the patient to be in obvious pain but not in the severe

collapse one sees with thrombosis of the coronary artery. He may lean forward, being most comfortable in that position. If the emphysema is in the neck or over the shoulders, one can feel it beneath the palpating fingers. The most characteristic finding, however, is the noise heard in the chest. This noise may, as in our case, be so loud as to be heard a foot from the patient without the aid of a stethoscope. It is a peculiar knock or click and at times resembles the squeak of a leather saddle. It may be synchronous with the heart beat, respiration, or both. The noise will vary markedly with a change in position. The area of cardiac dullness may be diminished to absent. X-ray examination will show a pneumothorax, if present, and at times it shows air along the lateral borders of the mediastinum and heart.

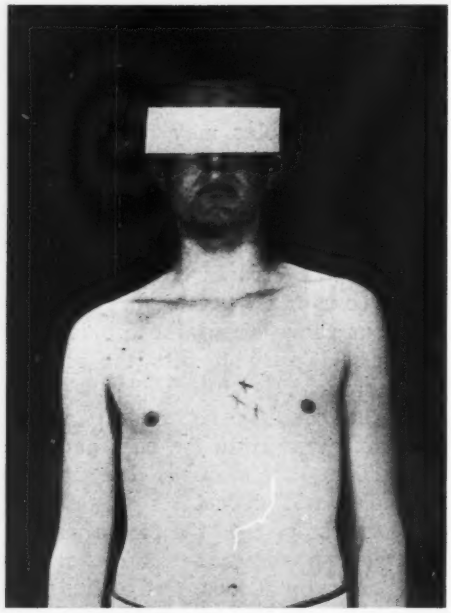


Fig. 1. Photograph of patient who appears healthy and well nourished. X marks the spot where the peculiar creaking noise was best heard.

The cases reported by Hamman (3) and Scott (6) required no treatment other than rest and sedatives for pain. Graded exercise was begun in from two to three weeks. Obviously the seriousness of this condition depends upon the amount of air that escapes from the lungs, and the pressure that builds up in the mediastinum. Ballon and Francis (1) have shown that the blood vessels of the mediastinum are the first structures to be compressed. This, in turn, produces cyanosis and air hunger. They recommend venisection for the cyanosis. It is possible that in cases of mediastinal emphysema active measures may have to be instituted. Cutting the skin over the neck to allow air to escape has been done. Stenbuck (7) suggests that an artificial pneumothorax be done to completely collapse the lung in cases in which the air continues to leak. Our case required no special treatment other than rest and sedatives.

Case Report.—R. W. G. was a husky, six-foot medical student, weighing 176 pounds: his family history was negative: he had had pertussis, mumps, and chicken pox as a child. He enjoyed good health until November, 1936, when he had a spontaneous pneumothorax on the right side. It was not associated with active exercise. Careful examination, including x-ray of the chest and tuberculin skin test, showed no evidence of tuberculosis. His blood pressure rose temporarily from normal to 160/76. He was kept on limited exercise until late in the Summer of 1937.

His examination before beginning his medical school work in October, 1937, showed a small left varicocele. His blood pressure was 126/80, the urine was negative, chest x-ray negative, and tuberculin skin test questionably positive.

March 1, 1938, while working over a Haldane apparatus, he suddenly developed a severe pain in the left upper precordial region, a pain which was also referred to the left shoulder. The patient had to go home and rest. He slept well that night but next morning the pain was still present and extended down his left arm as well as being present over his heart and in his left shoulder. He said he felt better if he sat bent forward. The pain differed from the pain of his previous pneumothorax. This

pain was gripping in character, whereas the other was more of a dull ache and did not radiate. It was on the morning of March 2 that he became conscious of the knocking and clicking in his chest. At

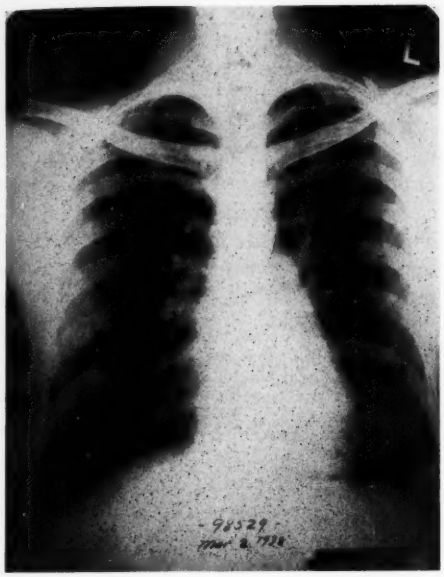


Fig. 2. Roentgenogram of chest showing normal heart and lungs and small apical pneumothorax on left. The thin layer of air just outside the pericardium is not demonstrable in reproduction.

times he could feel it and at other times he could hear it. Anyone standing directly in front of him could hear the noise. It seemed to the patient to be related to both inspiration and heart beat since it occurred regularly with the heart beat during held expiration, and decreased or disappeared during deep inspiration. This noise was best brought out by lying on his left side. It was obviously due to compression and expansion of the mediastinal interstitial emphysema by the beating heart. Swallowing did not produce any noise or sensation.

The patient did not appear acutely ill. His temperature was 97.2° F.; his pulse, respiration, and blood pressure were normal. Examination showed the lungs to be normal. The cardiac dullness was not obscured. Upon auscultation, noises described by some as clicks, knocks, or a "leathery noise" were heard. These noises were heard in the second and third left

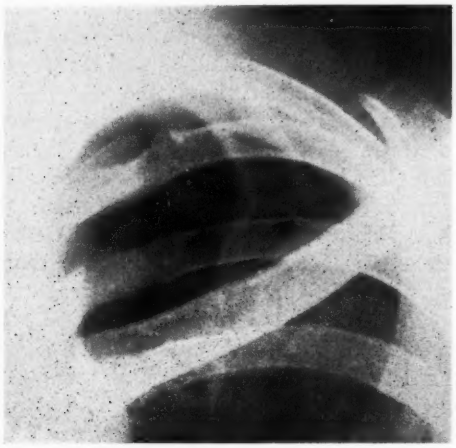


Fig. 3. Enlarged section of roentgenogram shown in Figure 2, showing pneumothorax at left apex and the slight thickening of the visceral pleura over the apex.

interspaces and over the upper sternum when the patient was in a sitting position. They came intermittently, and apparently were synchronous with the heart beats. They were best heard with the patient lying on his left side and in that position they were heard over the third and fourth left interspaces. There was never any subcutaneous emphysema in the neck.

X-ray examination March 2, 1938, showed a small pneumothorax on the left, with a maximum collapse of 2.5 cm. over the apex. The pleura was slightly thickened here, but there was no evidence of pulmonary tuberculosis. There was a slight amount of free air along the left border of the heart. A follow-up x-ray examination two days later showed a definite decrease in the size of the pneumothorax and failed to show any free air in the mediastinum. Three weeks later the pneumothorax had completely disappeared. The precordial pain gradually subsided, so that by March 8, 1938, one week from

the time of onset, the precordial distress had disappeared entirely. The crackle in the chest persisted for two weeks. An electrocardiogram, taken two weeks after the attack of pain, was essentially negative except for slight right axis deviation.

April 12, 1938, the patient returned for a check-up. He said that he felt fine. His weight was 184 pounds and his physical examination was negative.

April 16, 1938, the patient was allowed to throw a tennis ball around. While doing this he was conscious of what felt like a "stitch" in the left chest just lateral to the precordium. He paid very little attention to it. Next morning, while reading, the pain came on in the left chest as before but not nearly so severe. It radiated to the left shoulder but not down the left arm. The pain never was felt in the right shoulder or arm. The knock could be felt and heard again by the patient and with the stethoscope. It was heard best, as before, with the patient on his left side, over the third and fourth interspaces. There was no change in temperature or pulse. It was more related to breathing than to heart beat this time.

The x-ray examination of his chest was negative except for a band of thickened pleura over the left apex. Within four days the pain had disappeared, and the knock was heard only occasionally after a deep inspiration.

CONCLUSION

The severity and location of the pain so closely resemble those described in attacks of coronary occlusion that it seems well worth while to present our case and call attention again to the fact that all chest pains are not angina pectoris. If diagnosed angina pectoris, obviously a great harm is done the patient. The noise heard could very easily be confused with a pericardial friction rub or might perhaps be entirely mystifying if this condition were not kept in mind.

Spontaneous mediastinal emphysema apparently is a rather benign condition, but it may recur and also may be associated with a spontaneous pneumothorax—all of which means loss of time to the individual. The mildness of the condition depends upon the quantity of air which escapes into the mediastinum. Most cases will clear up with rest, sedatives, and time.

Roentgenographically, one may be able to show the associated pneumothorax, if present. The mediastinal emphysema is more difficult to delineate, but it may be demonstrated by oblique or lateral roentgenograms, either in the anterior mediastinum, around the pericardium, or even along the larger bronchi in the posterior mediastinum.

SUGGESTIONS

There is no law to prevent roentgenologists from using their ears as well as their eyes in the attempt to make an accurate and helpful diagnosis. A stethoscope can conveniently be hung near a fluoroscope. Once this peculiar creaking sound of mediastinal emphysema is heard, it and its significance are not likely to be forgotten.

BIBLIOGRAPHY

(1) Ballon, H. C., and Francis, B. F.: Consequence of Variations in Mediastinal Pressure: Mediastinal and Subcutaneous Emphysema. Arch. Surg., **19**, 1627–1659, December, 1929.

(2) Faulkner, William B., Jr., and Wagner, R. J.: Fatal Spontaneous Pneumothorax and Subcutaneous Emphysema in an Asthmatic: Report of a Case with Bronchoscopic Findings. Jour. Allergy, **8**, 267–272, March, 1937.

(3) Hamman, Louis: Spontaneous Interstitial Emphysema of the Lungs. Trans. Assn. Am. Physicians, **52**, 311–319, 1937.

(4) Kirsner, J. B.: Subcutaneous Emphysema in Bronchial Asthma: Report of Case. Jour. Am. Med. Assn., **108**, 2020–2022, June 12, 1937.

(5) Matsugawa, D.: Mediastinal Emphysema, Complication of Artificial Pneumothorax. Quart. Bull. Sea View Hosp., **2**, 173–179, January, 1937.

(6) Scott, Angus M.: Significance of Anginal Syndrome in Acute Spontaneous Pneumomediastinum. Lancet, **1**, 1327–1330, June ɔ, 1937.

(7) Stenbuck, Joseph B.: Traumatic Subcutaneous Emphysema of Thoracic Origin. New York St. Jour. Med., **37**, 395–399, Feb. 15, 1937.

THE CO-RELATION OF PHYSICAL AND CLINICAL DATA IN RADIATION THERAPY[1]

By WILLIAM H. MEYER, M.D., *New York City*

Director, Department of Radiology, New York Post-graduate Medical School and Hospital, Columbia University

THE more important problems of radiation therapy can be roughly summarized as follows:

(*A*) The estimation of the radiosensitivity (1 and 2) of a given lesion (by biopsy study).

(*B*) The selection of the proper quality of radiation according to the location and depth of the lesion.

(*C*) Delivery to the lesion of the required radiation dose intensity.

(*D*) The number of portals (by crossfire) to be selected (with skin tolerance the limiting factor) to build up the required depth dose.

(*E*) The choice of treatment method:
- (*a*) Multi-unit single dose (destructive to superficial lesions).
- (*b*) Sub-unit with recovery *interval* (applicable to the more radiosensitive lesions).
- (*c*) Fractional cumulative (for all deeper seated and less radiosensitive lesions).

To bring to realization the importance of the subject matter under consideration, it might be well to put this in the form of two questions, namely:

(*a*) Of what significance are quality variations?

In terms of + − skin unit dose.

By absorption curves, by the 10 cm. depth dose, or by the *half value layer correlated* to *phantom measurements*.

In r, or in fractions or multiples of the *unit skin dose*.

(*b*) Just what does it mean when one records a certain number of r as dosage in radiation therapy?

A basic fact ever to be kept clearly in mind is that *ionometric dose calibration* in r *is a purely physical measurement*, and *has value in radiation therapy* only when properly *correlated* to biological reaction. With due respect for much important biological research and experimentation, nevertheless, in clinical radiation therapy, the *human skin* still remains the most practical guide as a biological *index* of dosage.

The variants of quantity, quality, and time, as well as the area, exclusive of the obvious inverse square distance rule, are under consideration insofar as these may influence the r dose in relation to a given reaction.

In this connection, it might be well to state that these variations are not hair-splitting, small percentage differences, but sufficiently large to afford clinically observable effects.

Clinical experience soon forces one to the conclusion that the r dose is not purely a mathematical compilation of the obvious physical factors.

[1] The present paper, received for publication May 18, 1938, is a correlation by the author from material presented by him as follows:

"Quality Selection in Radiation Therapy": Presented in part as exhibit at the Fifth International Congress of Radiology, Chicago, Sept. 13–17, 1937.

"The Co-relation of Physical and Clinical Data in Radiation Therapy": Paper read in full at the New York Roentgen Ray Society, April 18, 1938.

"A Qualitative-quantitative Concept of Radiation Therapy": Exhibit at Annual Meeting, New York State Medical Society, May 9–12, 1938, and paper (synopsis of same topic) May 11, 1938.

Observation indicates that with all other factors constant, there is a considerable difference in the r dose required for a given reaction, depending upon at least five important variants:

1. Voltage and filtration (wave length);
2. Size of portal (area exposed);
3. The intensity of dose administration, *i.e.* r/min., or
4. The rhythm or frequency of a given dose application;
5. The depth at which the calculated dose is delivered.

Notwithstanding experiments which indicate that the biological effect is independent of the wave length (3), there appears to be a definite difference in the reaction of *thin layers* of biological test material and *thick* human tissue mass.

Every radiotherapist of experience admits and uses a far greater r dose with strongly filtered rays than with low voltage unfiltered therapy (4).

Given information with respect to the radiosensitivity of a lesion, the next important item in our opinion is the proper selection of quality of radiation.

Whether the direct or scatter ray, recoil, or photo-electron be the effective agents in radiation therapy, the fact remains that only *absorption* can be the true index of work accomplished.

On *physical* grounds, for *calibration* purposes, the half value layer is practically accepted as the best method yet evolved for quality determination. If one knows the voltage and filter, then the half value layer affords as accurate determination as any other quality measure. However, these measurements are made in such materials as aluminum and copper, and for the sake of comprehension on the part of the practical radiotherapist must by some means be correlated with what transpires in the human body. For this purpose, we have carried the half value layer over into large water phantom measurements, with the idea that this affords the clearest concept of ray transmission and absorption similar to those in the human body.

Some points which I wish particularly to emphasize are:

1. By *over-penetration* one invites unnecessary *damage to deeper lying tissues.*
2. Over-shooting results in a lowered unit mass absorption, and
3. A heavy exit dose (to small and medium sized parts) curtails cross-fire efficiency.

Since the half value layer lends itself to the more rapid comprehension of the subject matter at hand, I shall restrict myself to it in the designation of ray quality.

The clinical radiologist must establish a fundamental working hypothesis based upon sound experimental facts; otherwise he is at an utter loss to evaluate or correlate the clinical observations and results.

QUALITY SELECTION

The method of quality selection employed by us is illustrated by Charts 1 to 8. Chart 1 is a key chart in which the main sketch is designed to illustrate the respective quantities of various qualities of radiation that comprise the *heterogeneous* bundle of unfiltered radiation from a medium hard tube. The curve is exponentially that of transmission through successive thicknesses of aluminum as indicated on the right. One will observe that the half value layer of this particular beam is at about 1.5 mm. of aluminum.

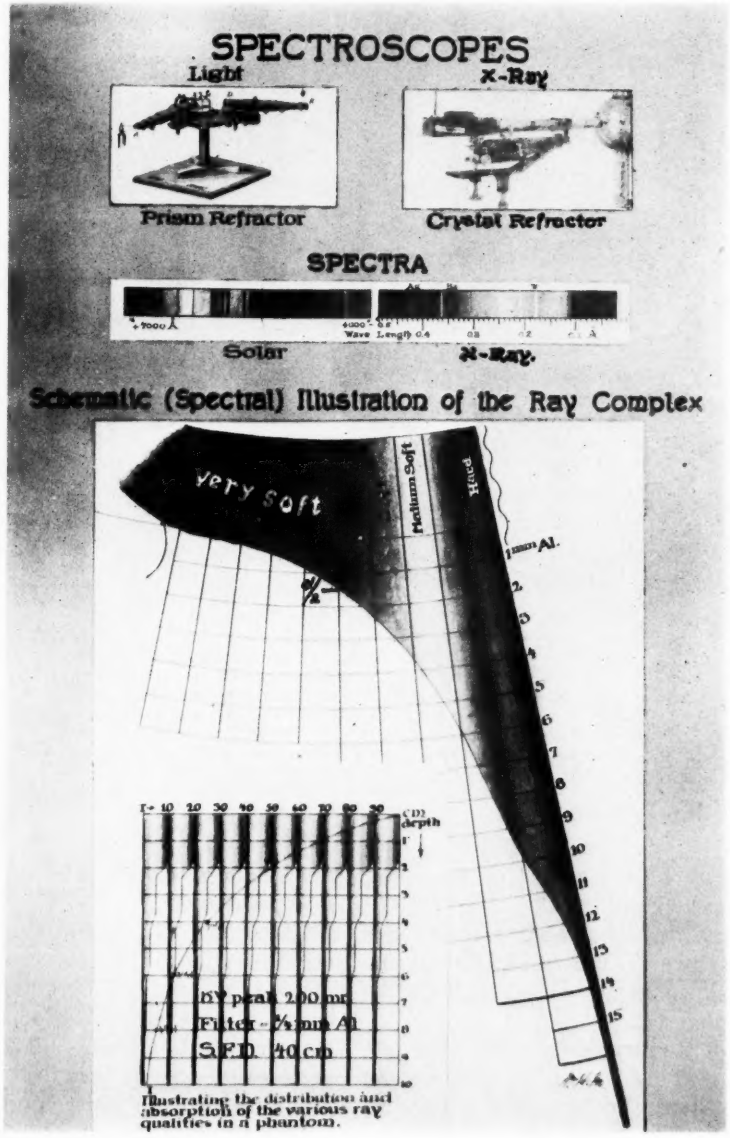
The illustration in the lower left-hand corner is merely presented to indicate that absorption occurs throughout the medium.

In succeeding sketches (shaded to indicate the color scheme of the originals), the crosswise shading of the absorption curves indicates the levels at which certain qualities of radiation are, in the main, absorbed. The absorption curves are exponential, but based upon measurements in a large water phantom (by Glasser).

In the study of the transmission curves of the several ray qualities illustrated, a point to which we wish to call attention is the relative size of the small wedge-shaped blocks along the left-hand curve, wherein the difference between the incident

and transmitted intensities of the first and each succeeding centimeter depth is designated as radiation lost or absorbed. The quantity of *radiation absorbed* in any given thickness of tissue.

The larger blocks indicated by the first,



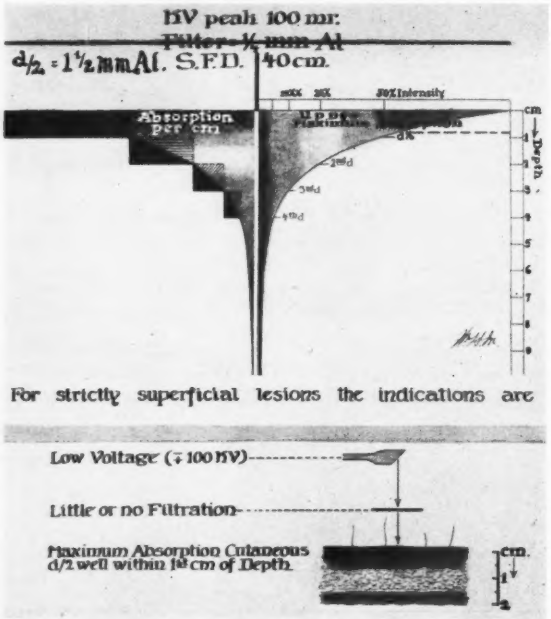
In Qualitative Chart No. 1, we have employed the spectral colors (shown here by shading) to illustrate the relative quantities of the various ray qualities composing an x-ray beam. The radiation here indicated is unfiltered with approximately 100 kv. (For further detail, see text.)

fact is that *the effective radiation* is not the percentage intensity transmitted, but the second, and third half value layers also give a relative concept of the effective part

of the ray bundle and not the percentage intensity transmitted.

The right and left curves were drawn in somewhat less than the first centimeter depth of water phantom.

This and softer types of radiation are,



In Qualitative Chart No. 2, the right-hand curve is one of transmission in a large water phantom. The centimeter depth is indicated on the right. The top lines represent 100 per cent surface intensity. The respective half value layers are indicated. On the left (simply a reverse of the other curve), the absorption blocks of each succeeding centimeter depth are indicated. In this particular instance, the half value layers correspond practically with 1 cm. Attention is called to the relative sizes of each of the blocks and to the fact that the upper zone is that of maximum absorption.

merely to avoid the complexities of the several data represented.

It is gradually becoming evident that the physically (air) measured r is not the absolute clinical gauge of dosage that some presumed it to be.

To the iontoquantimeter, 600 r is just that and nothing more: In the human organism there are introduced the influencing factors of quality, area, time, mass, and relative sensitivity, of which ionization takes no heed.

Chart 2, Low Voltage and Weakly Filtered Radiation, is presented in illustration of the fact that with low voltage and weak filtration, the maximum absorption occurs therefore, indicated only in superficially located lesions.[2]

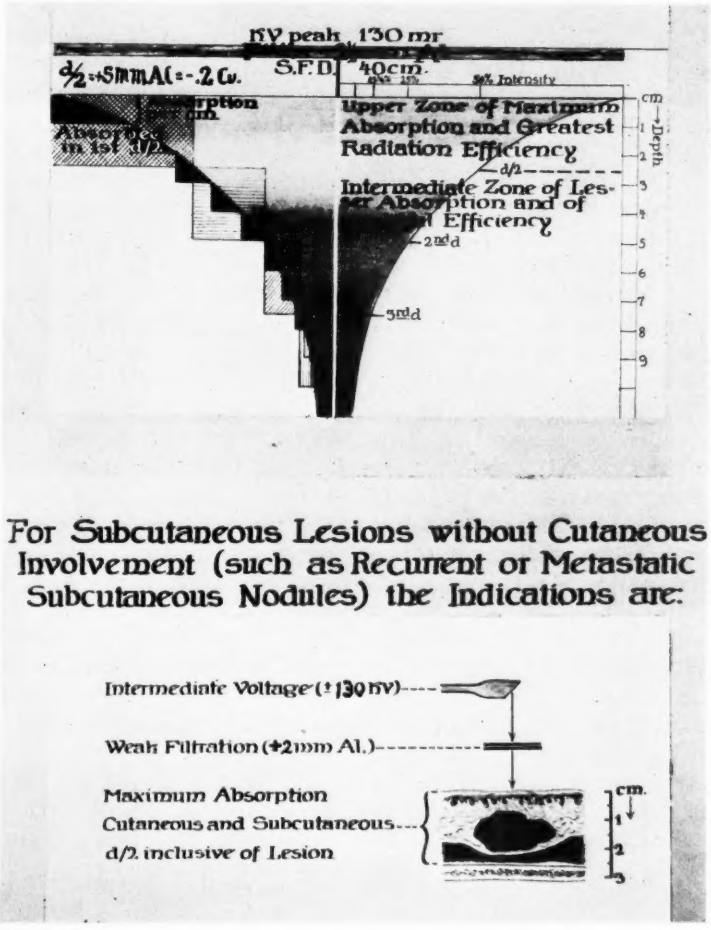
Chart 3, Medium Voltage with Moderate Filtration: In this chart, with increased voltage, but more particularly because of moderate filtration, a somewhat greater depth dose is obtained. Fifty per cent absorption is indicated within the first 2 cm. depth. This type of radiation is better suited to deeper infiltrating cutaneous and subcutaneous lesions.

In cases in which deeper reactions and

[2] Because of the difficulty of measurements with soft radiation in less than 1 cm. depth in water phantom, for all unfiltered radiation an aluminum scale in 0.2 mm. gradations is employed by us.

systemic effect are sought, then higher voltage and stronger filtration may be desirable. However, in superficially lo-

plying ray qualities as indicated in Charts 2 and 3, we would refer to an article published by us in 1921 (5), wherein we pre-



In Qualitative Chart No. 3, a ray quality is illustrated which is suitable for somewhat deeper infiltrative and subcutaneous lesions. (A more detailed description will be found in text.)

cated lesions, where heavy dosage is indicated, then it is most certainly illogical to employ highly penetrating radiation.

It is plainly discernible that in strictly superficial lesions, the lower voltage and weaker filter results in the maximum absorption at the lesion site with *minimal systemic effect* and *depth dose damage*.

With regard to the practicability of ap-

sented 100 consecutive cases of epithelioma treated by the multi-unit single dose method. A follow-up of five years and over revealed but a 2 per cent recurrence, wherein further treatment was required. By the use of radiation of such low penetration, wherein 50 per cent of the dosage is absorbed in the lesion, one minimizes damage to deeper tissues. In applying

this technic, the quality varies according to the thickness of the lesion. (With such qualities of radiation, the erythema skin unit dose ranges from 350 to 400 r.) The technical factors were as follows:

Skin-focus distance, −30 cm.
Qual., d/2 in 0.5 to 2 mm. Al
150 r per minute dose administration
Total r { large lesions 4 to +6 cm. −2,500 to 3,000 r = (6 to 8 E.S.U.)
small lesions 1 to −2 cm. −5,000 to 6,000 r = (12 to 15 E.S.U.)

It should be noted that heavier dosage is required with smaller lesions. This reveals the fact that iontoquantimetric measurements are not synonomous with clinically observed reactions. In this instance, the influence of the size of the area on the applied dose is illustrated.

A case of papilloma back of the right ear showed complete regression of the lesion by radiation therapy with the technical factors the same as for treatment of epithelioma, as outlined. Fifteen years later an ulcer appeared on the inside of the concha with a small local area of cartilaginous degeneration, suggesting perhaps unavoidable lack of protection and overpenetration.

Chart 4, Intermediate Voltage and Filtration, indicates that with a filtration of 4.5 mm. Al, the half value layer or 50 per cent absorption occurs within about the first −4 cm. depth. This type of radiation is, therefore, best suited for lesions located somewhat deeper and for subcutaneous lesions, affording increased protection to the superficial layers, moderate improvement in the depth dose, and a minimal exit dose.

This treatment form is also suitable for small and medium sized parts where a build-up of the depth dose is to be obtained by the cross-fire method. The lesion, of course, should be located within the zone of maximum absorption.

Of all types of cases presented for radiation therapy, children require the most careful consideration with regard to possible damage to young and rapidly growing more radiosensitive tissues. We have observed, perhaps in several unavoidable instances, arrested development and interference with growth as a result of radiation therapy with dosage not even sufficient to show any superficial reaction.

An example of a type of lesion wherein great care in applying radiation therapy is required is in the treatment of abnormal thymic enlargment. We have well over a thousand of this type of case, wherein naught but beneficial results have been obtained. We believe this due to the fact that we have assiduously avoided overpenetration, the half value layer never extending beyond the presumptive depth of the lesion. Again, because of the sensitivity of thymico-lymphatic tissue, heavy dose intensities are not required.

The method of treatment employed by us in this type is the fractional interval dose method. The quality varied from d/2 to d/4 (as shown in Charts 3 and 4), according to the size of the child and the thickness of tumefaction. The maximum single surface dose applied is 200 r. This is repeated not more than twice at ten-day intervals. Two treatments usually suffice. More than three treatments are never used, since our experience would indicate that that tumefaction which does not yield is due to some other cause than thymic hyperplasia.

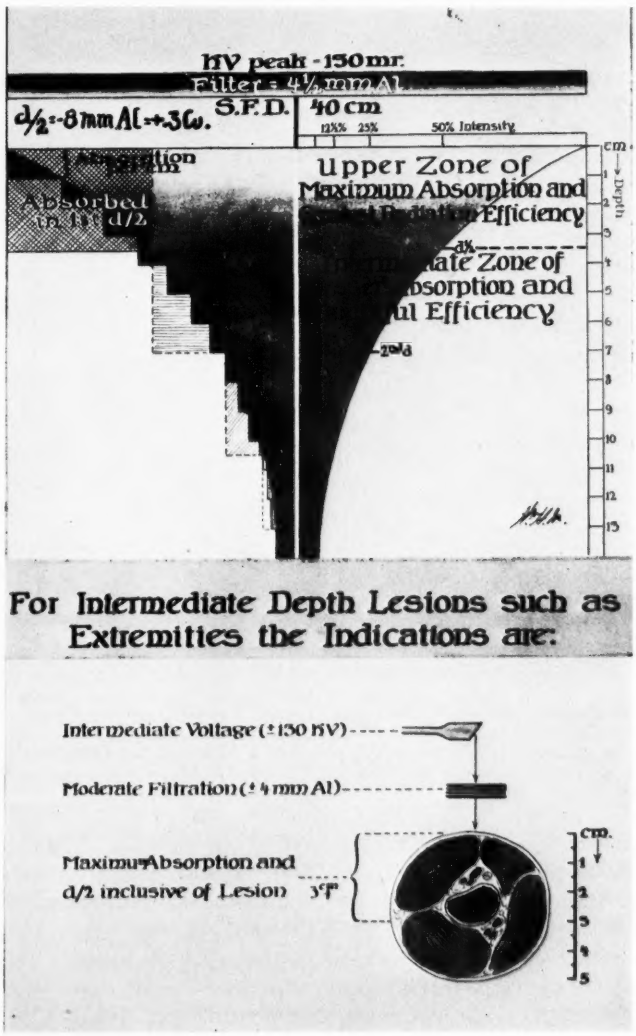
Though we have used the thymic cases as an illustration, the same care in the proper quality selection in children is necessary irrespective of the type and location of the lesion.

In view of the many experiments on plant life, seedlings, and lower animal forms, there is no need of further proof of the inhibitive effect of even moderate irradiation. (In this connection, we have presented a case of unavoidably arrested development from irradiation eight years previous. This was a case of endothelial sarcoma of the ulna. The dosage applied was never sufficient to cause any visible skin reaction. *Both bones* of the forearm are about one inch shorter than on the opposite normal side.)

Chart 5, High Voltage and Strong

Filtration: The type of radiation here illustrated is intended for intermediate depth lesions or those coming within the first six or seven centimeters depth as indicated by the half value layer. This chart is inserted because it is illustrative of an absorption curve which corresponds most closely to that employed by a considerable number of installations throughout the country, where higher voltage equipment is not available, namely, 180 to 200 kv. and 0.5 mm. Cu filter.[3] I think that this particular form is of limited value in extremely large individuals with deeply located lesions. Some of this difficulty can be overcome by employing greater filter thickness, as indicated in Chart 8.

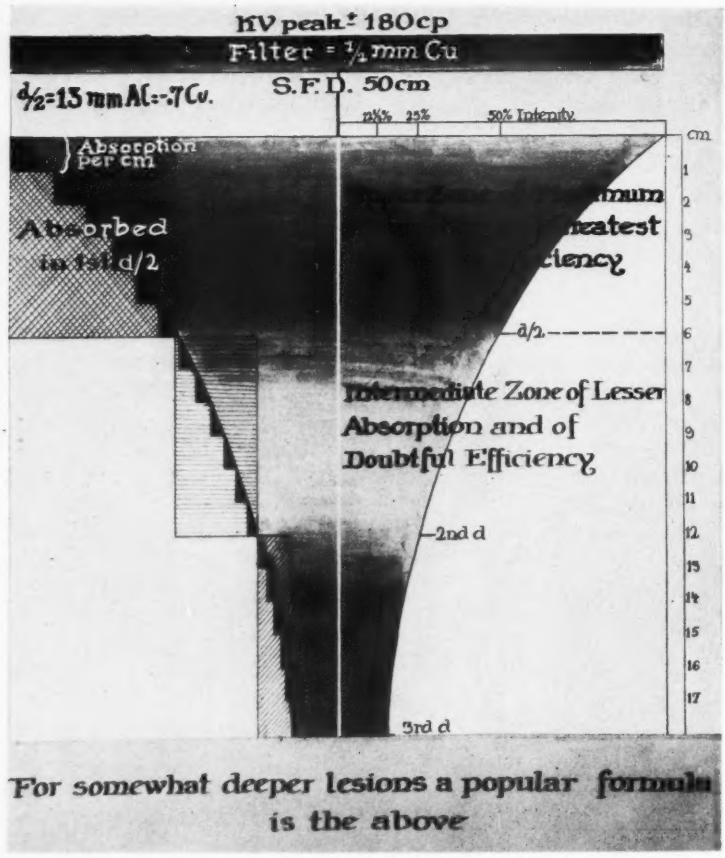
[3] Cu filters are faced with 1 mm. Al.



In Qualitative Chart No. 4 is illustrated a quality of radiation better suited for intermediate depth lesions in small parts wherein minimum depth dose damage and better cross-fire efficiency are desired. In this and each succeeding chart, by study of the size of the absorption blocks, it becomes evident that lesions will receive a maximum radiation effect if placed within the first half value zone.

Here, however, I wish to reiterate that in cases in which damage to deeper seated, radiosensitive tissues or organs might result from the selection of a too penetrating ray quality, it would appear advisable to select a lower ray quality, one wherein the lesion would be encompassed within the first half value layer, thereby minimizing the damaging effect beyond the lesion as well as reducing the exit dose, and enhancing the possibilities of building up a better depth dose by the cross-fire method.

The benign and more radiosensitive malignant lesions of intermediate depth would appear to be those in which the most careful selection of ray quality is indicated. In the light of our present knowledge, this group is as follows: Lymphoblastoma, 15; lymphogranuloma (Hodgkin's disease), 189; lymphosarcoma, 82; lympho-epithelioma, 6; leukemias, 26; endothelial sarcoma, 3; embryonal carcinoma (testes, ovary, and kidneys), 34; chronic adenopathy (?), 11.



In Qualitative Chart No. 5 is illustrated a ray quality which appears to be one of the most popular forms at present in use with a 200 kv. installation in the treatment of deeper seated lesions. We personally feel that a somewhat superior quality and homogeneity of radiation is obtainable if a 0.75 mm. Cu filter is used, as illustrated in Chart No. 7.

As reference, we might cite an article published in 1921 (6). Since that time we have increased our series to a total of 366 cases, variously diagnosed as the above. We have included these various pathological processes in one group, since their

response to radiation therapy is reasonably within the same limits. Regression in most instances is obtainable with dosages equivalent to from one-third to one-half of a skin unit dose delivered to the lesion.[4]

Whereas in former years, we employed the sub-unit interval dose method in the treatment of this type of case, we are today using the limited cumulative fractional method. I must admit that I am not yet quite convinced of the superiority of the latter, providing the sub-unit interval method be properly calculated and administered. In either instance, we are careful to select the quality of radiation most suitable to the case at hand, it being our effort to place the lesion within the first half value layer as gleaned from phantom measurements and as illustrated in the charts thus far shown.

The technical factors we at present employ are:

Quality variations, according to the size and depth of the lesion, from d/2 −4 to 8 cm. in H_2O phantom.
S.F.D., 50 to 70 cm., r/min. at 32 and 16, respectively.
r per area 160 to 175, number of areas, 2 to 3.
Rhythm, alternate days for each area.
Number of treatments, depending upon the particular type and sensitivity of the lesion (average 6 to 9 treatments).
Total dose, from 1,000 to −1,500 r per area.

A case of chondrosarcoma of the ilium observed six years after treatment reveals the fact that even the fractional method of irradiation, if too frequently repeated, may also result in late skin changes, telangiectasis, atrophy, etc. This is one of the many confirmations of our often repeated statement that there is no such thing as absolute decadence of any radiation dosage that approaches even a sub-erythema dose, no matter how applied.

[4] In the exhibit there were one or two photographic illustrations of each of the pathological processes above mentioned. The figures refer to the number of individual cases, totalling 366. The purposes of referring to this series of cases is to illustrate the uniformly satisfactory results obtained by the technical procedure and method of quality selection here presented.

A number of lesions less sensitive than the group above referred to were also shown, wherein by the cumulative fractional method of radiation therapy, satisfactory results were obtained.

We have seen several cases of pleuropulmonary fibrosis resulting (perhaps unavoidably) from over-penetration.

Most of these are post-operative local recurrences with axillary and cervical metastases, as well as a few in our series wherein a carcinoma also developed in the opposite unremoved breast.

I am convinced that some of these serious after-effects can be prevented by proper technical application and avoidance of over-penetration by the selection of the most suitable ray quality, as illustrated in Chart 6, and avoidance of over-penetration as is shown in Chart 7.

Chart 6 illustrates the advantage of proper quality selection for the particular case at hand. By having the lesion within the zone of maximum absorption, one minimizes damage to the deeper lying tissues. (Note that the lesion is encompassed within the first half value layer.)

Chart 7 shows the disadvantage of over-penetration with resultant damage to deeper lying tissues. Who of us, with sufficient experience and the courage to survey the follow-up observations, has not seen the suffering due to post-radiation damage and fibrosis? (Note that in this instance, the first half value layer extends almost twice the depth of the lesion.)

Chart 8, High Voltage with Very Strong Filtration: The absorption curve here illustrated comes close to the practical working limits of the depth dose obtainable with the usual 200 kv. installations; filtration beyond the 2 mm. copper here indicated results in but little improvement of the depth dose. It is self-evident that the purpose of such ray quality is for the treatment of deep seated lesions in heavy patients.

Taking advantage of the fact that a moderate variation of the depth dose is obtainable by variation of the focal distance, one observes that with 200 kv. and the same filtration, if the focal distance is increased by about 50 per cent, practically the same depth dose and half value layer is obtainable as with a 400 kv. installation. The d/2 layer under either of these

conditions approaches the ninth centimeter depth in the water phantom.

Though all tissues may be said to have a given degree of radiosensitivity, and encouraging results have been obtained in a selected group of cases, nevertheless the sensitivity of certain types of malignancies (such as deep-seated adenocarcinomas) is so low that it may well be said that they are radioresistant in relation to the neighboring normal tissue. Apropos of this, and I trust without appearing too pessimistic, I may say that I know of no cases of adenocarcinoma of the liver or hepatic duct system, pancreas, stomach or intestines, in which any lasting effects from radiation therapy alone have been obtained.

In the less sensitive types of deep-seated malignancy, the indications for pre-operative radiation therapy are to bring about as much recession as possible, checking cellular activity, and by the further reactive changes in the neighboring tissues and vascular supply reduce the chances of hematogeneous metastases and inhibit growth extension along the routes of lymphatic drainage.

Post-operatively prophylactic or palliative irradiation is indicated for reasons similar to those above enumerated.

It remains to be seen what the effects will be of the newer method of fractionation with increased voltage and filtration, most particularly if combined with the maximum practical number of portals for cross-fire.

Supervoltage with Very Strong Filtration.—From the foregoing, the indications for treatment of deep lesions would appear to be for much higher voltage and stronger filtration. The fact remains, however, that short of one million volts and filter equivalent for six or more millimeters of copper, the depth dose as indicated by the half value layer in a water phantom has, from the experimental data thus far presented, not yet exceeded the tenth centimeter depth.

RADIATION QUANTITY

Reaction vs. *the r Dose as the Measure of Ray Quantity.*—Other than increased penetration, the more promising principles upon which improvement in radiation therapy is anticipated are based upon a slower rate of dose administration wherein by lower intensity, fractionated rhythm, and cumulation, a somewhat different and more protracted reaction is brought about.

The clinical observations, however, indicate that there is a very definite difference between the skin and biological reactions in relation to the physically measured r dose. The main influencing factors requiring consideration are: (*a*) Quality in relation to depth; (*b*) size of area irradiated; (*c*) dose intensity, and (*d*) rhythm.

The first item is *the r dose* in relation to changes in *quality*. Many years ago, it was observed that for a given reaction the surface dose as physically measured increases with increased voltage and filtration (7).

Some years later, Glasser and I (4) ventured publication with some experimental data in relation to the variation of the r dose with changes in quality, and I take the liberty of presenting a more recent chart on this work (Chart 9).

One will note that whereas an erythema will result in the majority of cases with 350 r (measured in air) under the conditions given with low voltage and weak filtration, that over 700 r would be required if higher voltage and strong filtration are employed.[5] Therefore, as much as 100 per cent difference in the air-measured r dose may be ascribable to quality variation ranging from low voltage unfiltered to high voltage strongly filtered radiation. These differences appear ascribable to scattering and alterations in absorption in a given unit mass, as well as to change in dose rate.

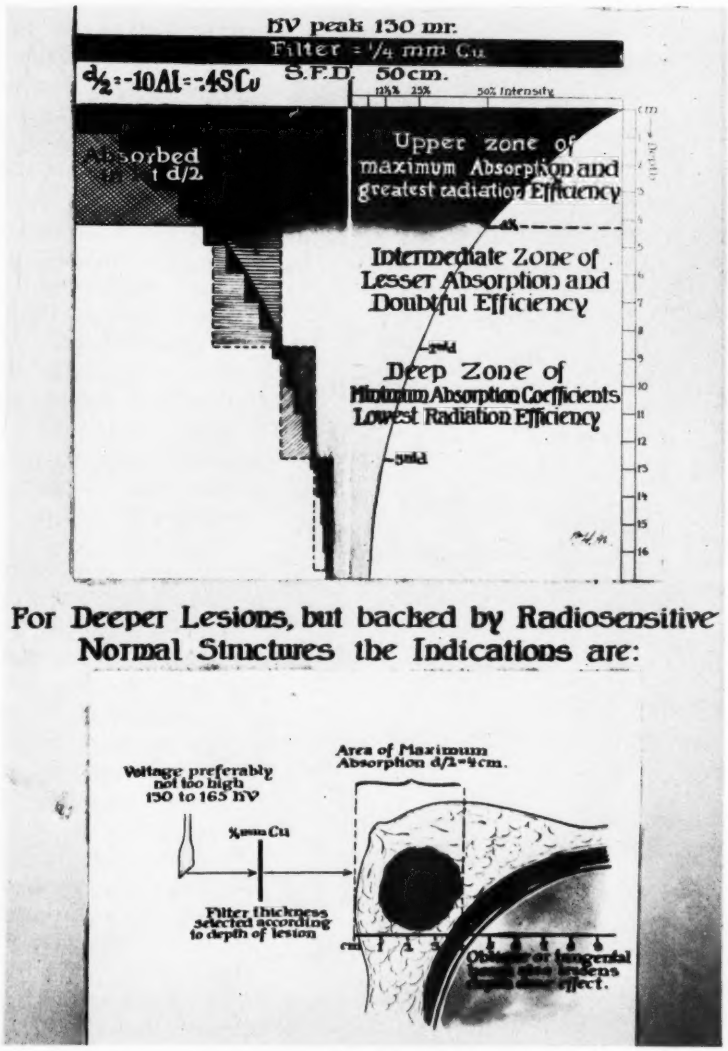
The Influence of the Size of Portal on the Total r Dose Required for a Given Reaction.—It is quite probable that some of the uncertainty regarding the erythema "as a

[5] The curve is drawn from experimental and treatment observations on 10 cm. circular areas—ionization measurements in air. The original experimental data were derived from an epilation on the scalp, a reaction more indicative of the inhibitive radiation effect. With us, this dose is synonymous with an erythema on an indifferent extensor surface.

unit dose standard" is due to oversight of the influence the size of the area irradiated will have upon the reaction produced by a given quantity of radiation (*i.e.*, the r dose).

areas could tolerate much heavier dosage. Thus, the smaller the area, the greater the r dose required for a given reaction.

On Chart 10, the ordinates (vertically placed) represent the diameters of circular


HV peak 130 mr.
Filter = 1/4 mm Cu
d/2 = .10Al = .4Cu
S.F.D. 50 cm.
12½% 25% 50% Intensity
Absorbed
t d/2
Upper zone of maximum Absorption and greatest radiation Efficiency
Intermediate Zone of Lesser Absorption and Doubtful Efficiency
Deep Zone of Minimum Absorption Coefficients Lowest Radiation Efficiency
For Deeper Lesions, but backed by Radiosensitive Normal Structures the Indications are:
Voltage preferably not too high 150 to 165 HV
Area of Maximum Absorption d/2=4 cm.
Filter thickness selected according to depth of lesion
Oblique or tangential

In Qualitative Chart No. 6 is graphically presented the advisability of selecting a ray quality best suited to the depth location of a lesion.

Though with large areas (perhaps from 10 cm. in diameter upward) but little variation in reaction to a given dose is observable, we have long since known that small

areas. The abscissa represents the total r dose required for a given reaction. The points indicate the result of our experience and experimental observations. An ex-

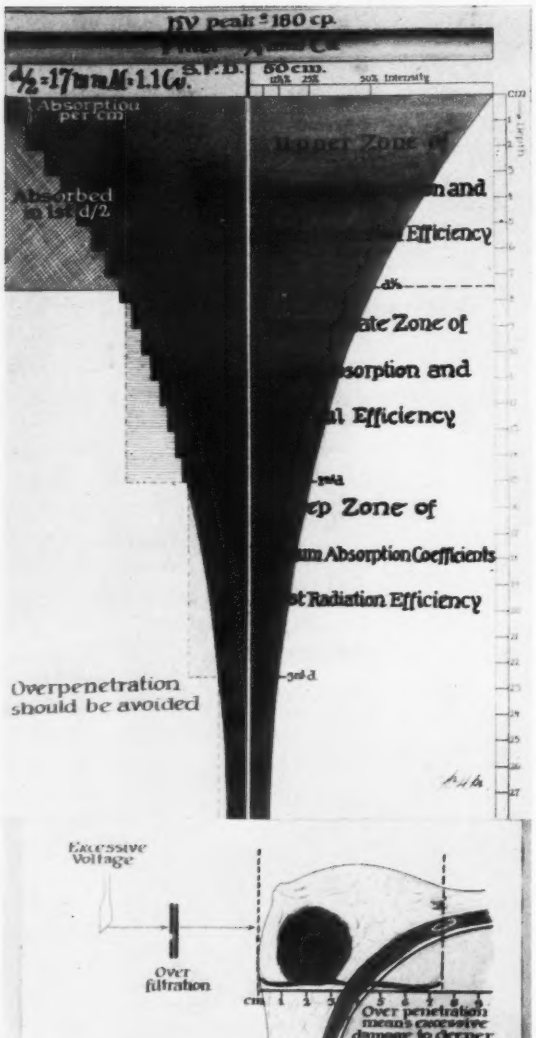
ponential curve which most closely approaches these points suggests that the total r dose varies practically as the inverse square root of the diameter of a circular area, or possibly as the inverse cube root of the area.[6]

Though there are undoubtedly other influencing factors (such as the more rapid recovery of small traumatized areas), nevertheless we have found the above working rule applicable in a wide diversity of cases as presented in our department.

The Effect of the Dose Intensity (in r/min.) on the Total r for a Given Reaction.—In Chart 11, we present an exponential curve which corresponds most closely to our clinical and experimental observations. The ordinates indicate the (r/min.) continuous dose application, the abscissa the total r dose for a given reaction. If the transcribed curve (dotted line) of Holthusen (8) is shifted from the zone of greater intensity, to the left, it will be found to coincide quite closely with our own data. The conclusion is that within practical working limits, the lower the intensity of dose administration (r/min.), the larger the total r dose for a given reaction. Hardly anyone will argue the statement that with the slower rate of dose administration or with the rhythmically repeated smaller dosage (through cumulation) are improved clinical results obtained.

The exponential curve we have drawn in Chart 11 indicates that the total r dose required for a given reaction varies approximately as the inverse cube root of the applied intensity, *i.e.*, r/min. dose.

The Influence of Interrupted or Rhythm Method of Treatment upon the Total r Dose.—The question of rhythm becomes a far more complicated matter to reduce to a work-



In Qualitative Chart No. 7, by contrast with Chart No. 6, is illustrated the likelihood of depth dose damage resulting from over-penetration. In this instance, the half value zone extends more than twice the depth of the lesion. Therefore, especially by cross-fire, will an excessive depth dose be accumulated. This is undoubtedly one of the reasons why serious pleuropulmonary fibrosis results from treatment of breast cancers.

[6] In this and the succeeding charts, the main heavy curves correspond to a full erythema dose. The lighter edge of the shaded area would more nearly represent a threshold erythema, or about 20 per cent less dosage than indicated by the curve.

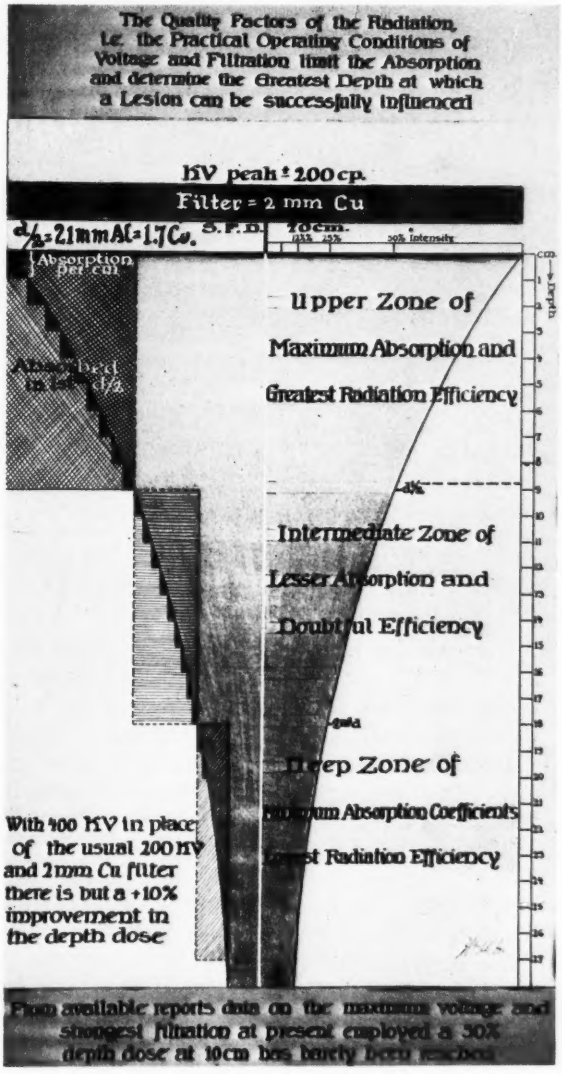
ing formula, since such great latitude of variation is possible. I have taken the liberty, however, of presenting Chart 12, which illustrates that the *same factors are effective as in the preceding examples*, namely, with reference to the influence of the r/min. rate of dose application.

One will observe that with heavy dosage frequently repeated a peak of maximal intensity is reached quite early, with a sharp skin reaction well in excess of the old standard erythema dose. On the other hand, with lower dose intensity, repetition is feasible over a longer period with a far greater total r dose from which, though the reaction appears severe, the skin recovers more satisfactorily than when the sharper peak reaction is obtained. The smaller the single dose, the more frequent the rhythm of repetition, the larger the total r dose for a given reaction. As one increases the initial r dose the recovery interval becomes longer and one approaches the old sub-unit interval dose method.

The data on Chart 12 are strictly empirical but based upon experimental and clinical observations, and are presented because some orderly mode or procedure must be maintained so that clinical-pathological observations and comparative results may be properly evaluated.

It is yet to be determined whether one method of fractionation has any advantage over another.

Whether a somewhat *heavier dose* at properly *estimated intervals* to meet the particular *sensitivity* requirements and recovery *cycle*, respectively, of certain of the more radiosensitive *lesions* may not be just as satisfactory as fractionation still remains to be proven. The mass of experience gained, and the often remarkable results obtained by older methods during the passing years should not be too lightly discarded. The constant technical revisions to comply with the biological reactions reveal the state of flux and lack of standardization of the principles involved.


The Quality Factors of the Radiation, i.e. the Practical Operating Conditions of Voltage and Filtration limit the Absorption and determine the Greatest Depth at which a Lesion can be successfully influenced
KV peak = 200 cp.
Filter = 2 mm Cu
Upper Zone of
Maximum Absorption and
Greatest Radiation Efficiency
Intermediate Zone of
Lesser Absorption and
Doubtful Efficiency
Deep Zone of
With 400 KV in place of the usual 200 KV and 2 mm Cu filter there is but a +10% improvement in the depth dose
From available reports data on the maximum voltage and strongest filtration at present employed a 30% depth dose at 10cm has barely been reached

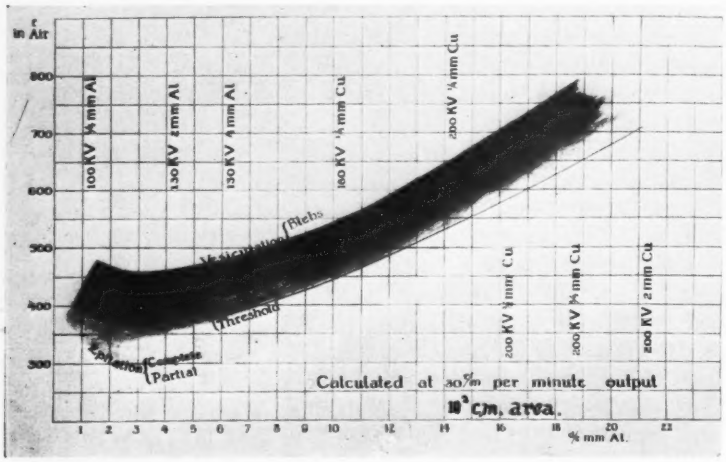
In Qualitative Chart No. 8, we illustrate the practical technical limitations with a 200 kv. installation. Increased filtration results in but little improvement in the depth dose. Therefore, practical homogeneity for this quality of radiation would appear to have been obtained. It will be noted that the half value layer approaches the ninth centimeter depth. Even with a million volts and increased filtration, the half value layer has as yet barely reached the tenth centimeter depth.

SUMMARY

Variations in the r dose depending upon changes of such physico-technical factors as amperage, voltage, filtration, and distance are quite obvious and reasonably calculable.

practical radiation therapy and has a most important bearing upon the actual depth dose and biological reaction desired.

The size of the portal has a definite bearing upon the number of areas for cross-fire to be used. For a lesion at a given



Quantitative Chart No. 9. For equal skin or biological reaction, the total (r dose) required depends somewhat upon the radiation quality. For a fairly uniform mild erythema reaction, the curve indicates a range from −350 r with low voltage weakly filtered rays to +700 r when high voltage and strongly filtered rays are employed. Several technical factors as employed by us are indicated on the chart.

On the other hand, the less evident but nonetheless important discrepancies between the r dose and skin or biologic reaction require most careful consideration.

Instead of attempting a summary of an already too condensed presentation, a few practical illustrations may be offered.

The schematic data illustrated in Chart 13 are presented because of the pronounced influence that the size of the portal or area irradiated will have upon the depth dose (here expressed in the half value layer). The influence of voltage and filtration upon the depth dose had ample illustration in the quality selection Charts 2 to 8.

In Chart 13 it will be observed that with a small pencil beam, the physically measured depth dose is far less than when a large area is irradiated (9), and that the range of error approaches 100 per cent.

The above mentioned fact, though well known, suffers considerable neglect in practical radiation therapy and has a most important bearing upon the actual depth dose and biological reaction desired.

The size of the portal has a definite bearing upon the number of areas for cross-fire to be used. For a lesion at a given depth, the smaller the size of the area irradiated, the greater the number of portals of cross-fire required for a predetermined depth dose. Therefore, different isodose charts for various sized portals must be available.

An error of over 50 per cent in depth dose can be demonstrated easily within the usual technical procedures when a single large portal isodose chart is employed in the calculations of the number of smaller portals for cross-fire. It stands without argument that in *deep-seated lesions* the *number of portals* for cross-fire is a *most important* factor in the delivery of a *proper depth dose.*

Composite Chart 14 will require considerably more detail study for comprehension of the several factors involved. Because of the change in voltage, milliamperage, filter, and distance factors, a difference in the unit mass absorption as well as a

wide variation in the (r/min.) time relation of dose administration is here introduced.

Concentrating on the figures on the horizontal line marked "surfaces," we note that the *physically measured r dose* for a is ascribable to higher voltage and filter factors, then one is most neglectful of the difference in biological effect due to the difference in the r per minute dose administration.

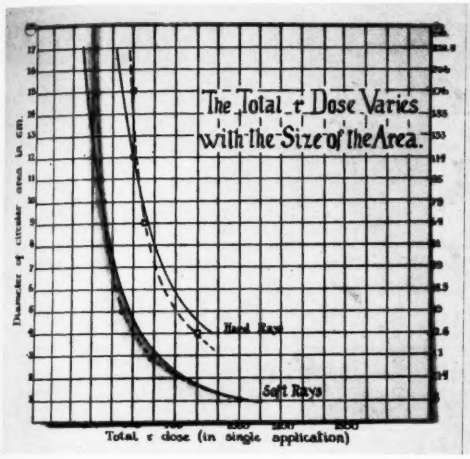


Chart 10.

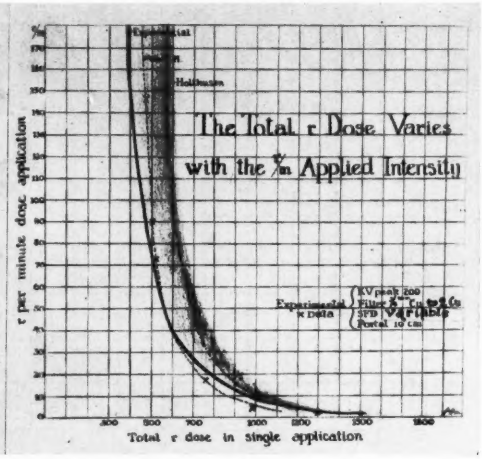


Chart 11.

Quantitative Chart No. 10. For a given reaction the total r dose varies approximately as the inverse square root of the mean diameter of the area. Our experience shows that small lesions require relatively very much heavier dosage than large involved areas. In a practical way and from information derived from the chart, this means that in treating two epitheliomas of similar radiosensitivity, one +8 cm. in diameter, the other −2 cm., the latter will require about twice the r dose. Thus, if complete regression (cure) is obtained in the large (8 cm.) lesion with from 6 to 8 erythema doses (2,500 to 3,000 r), then the small lesion (−2 cm.) would require from 5,000 to 6,000 r if similar results are to be obtained.

Quantitative Chart No. 11. For a given reaction the total r dose varies closely as the inverse cube root of the applied intensity (r/min.). As will be observed from the pitch of the curve, there is but little, if any, correction of the total r dose necessary when the r/min. dose rate is relatively large. However, when the rate of dose administration is slow, then a considerable increase in the total r dose will be required. The curve applies within the usual working limits of technic here applied. Thus, if one changes from (*60 r/min.*) at 200 kv. and 0.75 mm. Cu filter at 50 cm. S.F.D. to (*15 r/min.*) at 200 kv. and 2 mm. Cu filter at 70 cm. S.F.D., the total r dose required for a given reaction will increase from *550 r at 60 r/min.* to *750 r at 15 r/min.*

unit skin erythema *increases* with increased voltage and filtration. This is perhaps not alone due to altered absorption and scattering, but also to the marked change in the r/min. of dose application.[7]

Thus when the statement is made that with higher voltage and stronger filtration, the time factor for a given r dose at a lower r per minute rate is longer, the fact is quite obvious (namely, 60 r per minute for *10 minutes* is the same total r dose as 10 r per minute for *60 minutes*). When, however, one states that a minimal skin effect

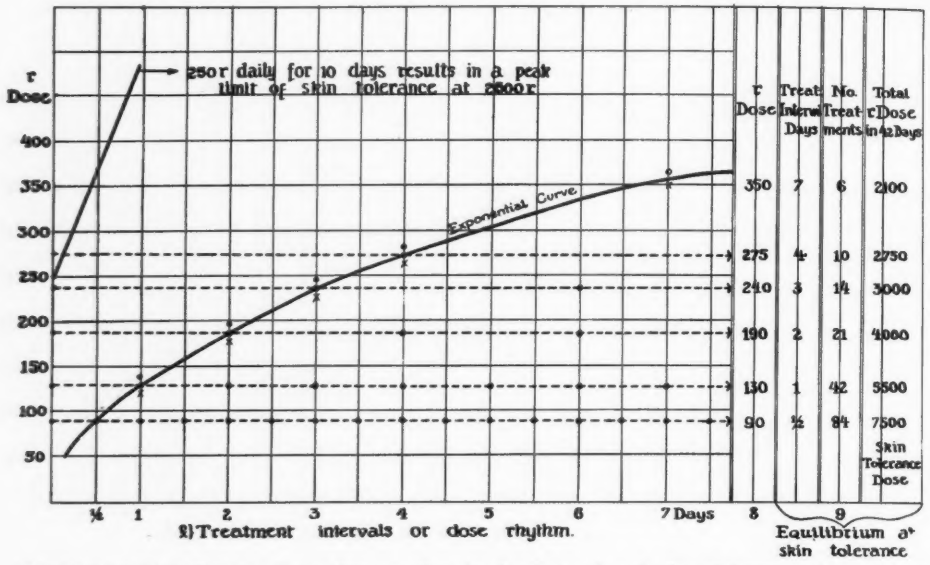
To the informed, the data given in Chart 11 are practically accepted, namely, that *for a given skin* (*biological reaction*), a *considerable increase in the total r dose* administered *is required* as the *r per minute of dose* administration *is lowered*. Therein, as well as in the altered quality, lies the difference of the r dose with different types of radiation as indicated along the (surface) line in Chart 14, and calculable from Chart 11.

The better to clarify the relation of the r dose in the depth to the probable biological effect, we have added supplementary Chart 15. The transmission curve is

[7] Surface dose measurements in air. Phantom measurements in H_2O.

practically that of Chart 5, wherein the centimeter unit absorption blocks and the half value layers have been reindicated.

If one accepts the statement that the lower the r/min. dose administration, the greater the total r dose required for a given



Quantitative Chart No. 12. For a given reaction the time interval or rhythm of dosage varies roughly as the square of the applied intensity (in r). The technical factors are: 200 kv. peak, filter, 0.75 mm. Cu, 50 cm. S.F.D., dose rate, 30 r/min. It has long been known that with repeated daily dosage of from one-third to one-half of a so-called skin unit, a considerable increase over the physically measured unit skin dose could be applied. The limit of tolerance, however, is usually reached within about ten days. With sub-unit dosage, *i.e.*, from 0.5 to 0.75 S.E.D., and an increase in the time interval between treatments (as indicated near the top of the curve), one approaches the old sub-unit interval method of radiation therapy. It is quite evident that with fractionation (below one-third the skin unit) more frequent repetition becomes practicable with a far greater cumulative total r dose attainable. Whether there is any real advantage or difference in the results obtained in the rhythms of fractionation, as indicated in the lower part of the curve (*i.e.*, below 150 r), is open to conjecture and proof. It is quite likely that each of the methods herein suggested, inclusive of the single massive dose, will find advocates depending upon the type, size, location, and radiosensitivity of a lesion and no standard stereotyped technic has yet been developed.

Presuming the 100 per cent surface dose on a water phantom (inclusive of backscatter) to be 800 r, then at the first half value layer, the physically measured r dose would of necessity be 400 r.

In addition to the altered absorption, there is a definite change in the r/min. dose rate at this depth, the same having dropped to one-half that at the surface, namely, from 32 r/min. to 16 r/min. at the first d/2 layer.

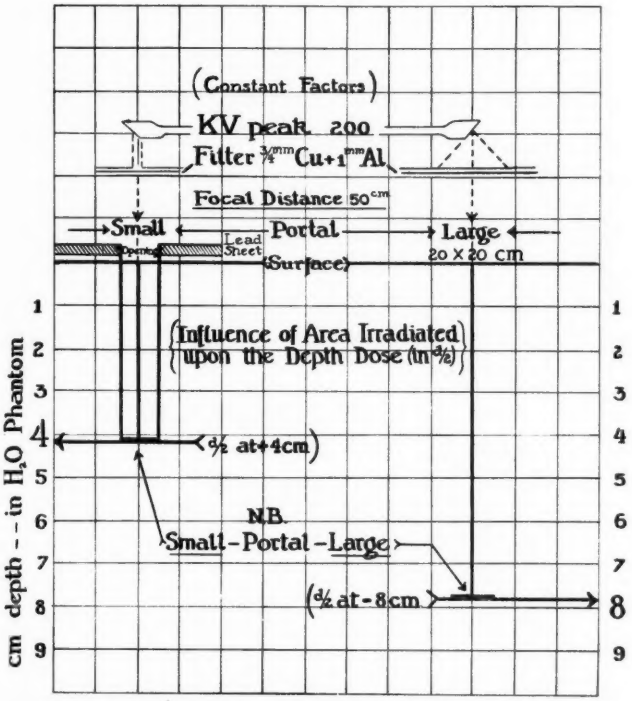
The deeper into the phantom one explores, the greater is the r/min. difference. Thus, at the second d/2 layer, the r/min. dose application is one-fourth that at the surface.

reaction, then for relative biological similarity, about 20 per cent greater dosage will be required at the first d/2 layer than indicated by the physically measured isodose chart. Again, at the second d/2 layer, a deficiency of about 35 per cent would occur from that indicated by the isodose measurements.

Stated from a more practical therapeutic standpoint, the isodose charts at the d/2 layer appear to indicate that the equivalent of a skin dose might be delivered to the d/2 depth through two equidistant portals of cross-fire.

It is more nearly the truth to state that with all factors receiving due considera-

tion, practically three portals of cross-fire, with similar physically measured dosage, will be required to obtain at the indicated depth, a biological effect similar to that at the surface. (Incidentally, a far greater uniformity of dose distribution is obtained when three properly applied portals of cross-fire are employed.)



Quantitative Chart No. 13. The depth dose (d/2) with a large portal is almost double that of a small pencil beam. It is important to keep in mind that a change in the size of the portal irradiated has a definite influence on the depth intensity; therefore, no single isodose chart even for the same quality of radiation will suffice. It might also be noted that with gross changes in focal distance a moderate change in the depth dose distribution also occurs; however, with the usual standard technic, this is not serious.

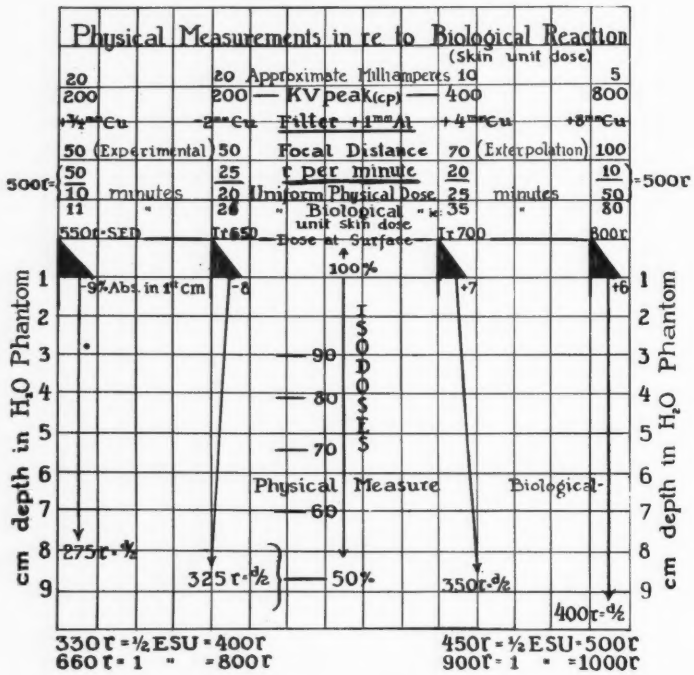
The basis upon which this supposition is founded was the treatment of 100 consecutive cases, where a castration dose in females was indicated and wherein the single treatment method with from one to five areas, depending upon the size of the patient, was employed. In all of these, the effort was made to deliver the equivalent of one-third the skin unit dose to the estimated ovarian depth. Isodose charts were employed for calculation of this dosage. We were successful with the single treatment method in bringing on a cessation of the menstrual function in small and medium sized patients, but repetition of dosage was required, with consequent failure of proper dose calculation, in the very large and obese individuals. Re-calculation and treatment with the revised isodose chart to be shown has since brought success, irrespective of the size of the patient.

The fact I wish to reiterate is that the r per minute dose administration is lower in the depth than at the surface. Therefore, as an increase in the total r dose at the surface is required for a given reaction when the r per minute is lowered, so for the same reason, an increase in the depth dose

must also be allowed, this being supplementary to the altered absorption due to the change in ray quality.

Chart 16 is purely illustrative of one of the several depth dose charts employed by

Study of the chart will reveal the fact that at the first half value layer, fully 20 per cent greater physically measured dosage is necessary for similar to one-half surface reaction. The *deeper the area* to be



Quantitative Chart No. 14. The higher the filtration, the greater the discrepancy between the physical r and biological skin dose. In this chart the more important influencing factors have been combined to illustrate their pronounced influence upon the r dose in relation to the biological reaction. The technical factors influencing the surface dosage have practically been accepted quite as presented by us many years ago. However, that the same factors are also effective in the deeper parts of the body does not seem to have been brought to notice. For clear comprehension of the influence of the altered absorption as well as the difference in the r/min. dose rate in the deeper areas we will, in Chart 15, analyze but one of the vertical depth dose lines.

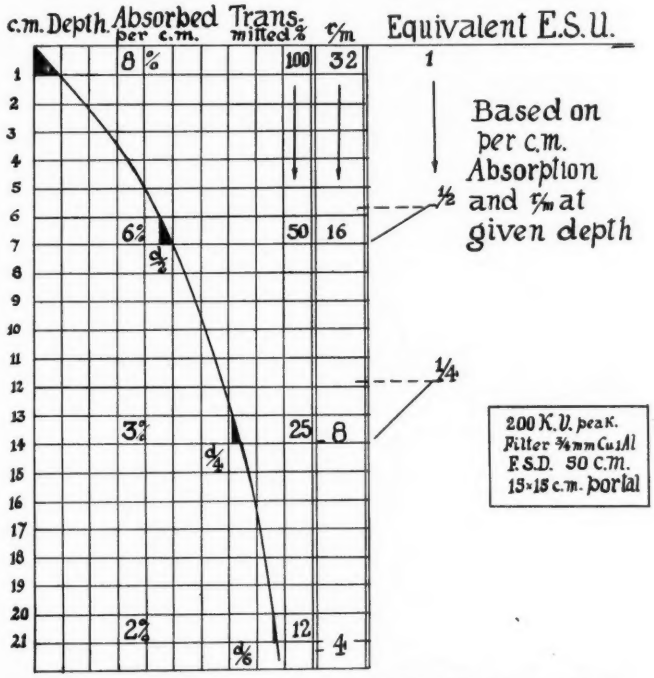
us wherein the physically measured isodose lines are used to determine the percentage depth dose delivered as well as the number of portals for cross-fire to be used for a certain cumulative effect. We have taken the liberty of showing that, purely from the standpoint of r/min. dose administration, the physically designated data cannot possibly indicate the biological effect.

irradiated, the *greater is the discrepancy* between the physically measured and biological dose requirement. At the second half value layer, practically one-third more than the physically indicated dosage will be required. For example, if by physically calibrated isodose charts, four areas for a given dose are indicated, the biological requirements would call for six areas for a

lesion located inside the second half value layer.

Isodose Chart 17 is presented merely to illustrate that with change in portal size, a very different depth dose effect is obtained and that different isodose charts are essential for each marked change in portal size as well as with change in ray quality.

In conclusion, it is evident that in a presentation covering so extensive a field as this, most of the detail of experimental data had to be omitted. However, for much of the material, especially with respect to the physical data pertaining to the half value layer and comparative quality measurements as well as the relation of quality to the r dose, I express my appreciation of the



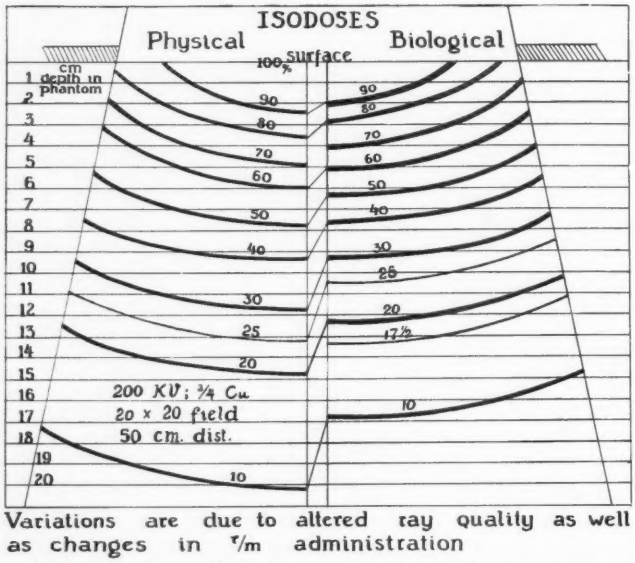
Quantitative Chart No. 15 (supplement to Chart No. 14). In this chart we have practically transcribed the transmission curve from Chart No. 7. From this, one will observe that the radiation lost in the first centimeter depth approximates 8 per cent. Near the seventh centimeter depth, the loss is about 6 per cent, whereas at the fourteenth centimeter depth this block wedge drops to 3 per cent. These are designated at the successive half value layers. Therefore, the transmitted intensities, respectively, are 50 and 25 per cent.

100% at surface	Loss in first cm. 8%	r/min. 32
50% at the first d/2 layer	Loss in seventh cm. 6%	r/min. 16
25% at the second d/2 layer	Loss in fourteenth cm. 3%	r/min. 8

If one adds to the *altered absorption* at various depths the fact that the *r/min. dose rate* is also changed, it should be apparent that the physically measured isodose intensity requires revision for translation into terms of biological efficiency. Whereas this appears not at all serious so long as a lesion is located within the first half value layer, yet the greater the depth, the greater the discrepancy between the physically measured intensity and the actual biological dose. Experience has taught us that beyond the first half value zone, allowance for these discrepancies must be made.

collaboration of Dr. Glasser, Dr. Braestrup, and Dr. Mutscheller.

The correlated clinical observations herence to the physically sound half value quantitative-qualitative method that this concept has been developed.



Quantitative Chart 16 is but one example of the isodose charts prepared by Dr. Glasser upon which the original physical isodose lines are indicated to the left. On the right the correction factors depending upon slower r/min. dose intensity as well as altered unit mass absorption have been designated as an index of biological efficiency.

cover a long period of changing technic, during which the *reported* experience of others was freely consulted.

I also wish it understood that some of the conclusions and formulæ presented are subject to further experimentation and revision. The material presented is the working hypothesis upon which our radiation therapy technic has been developed. Without a technically sound foundation, clinical observations become but chimerical guesswork and I believe that our own progress along these lines is due to the fact that more than a quarter-century ago, I saw the reason and heeded the advice of Christien: That eventually all qualitative dose measurements will have to be calibrated against the half value layer. Various methods of quality and quantity measures have come and gone, and though we have changed the media, it is through ad-

To summarize the material presented, the observations are:

1. That for each type and location of lesion, there is a more or less specific quality of radiation best suited for the case at hand.

2. The effort should be made to select that ray quality wherein the maximum absorption will be brought to bear upon the lesion.

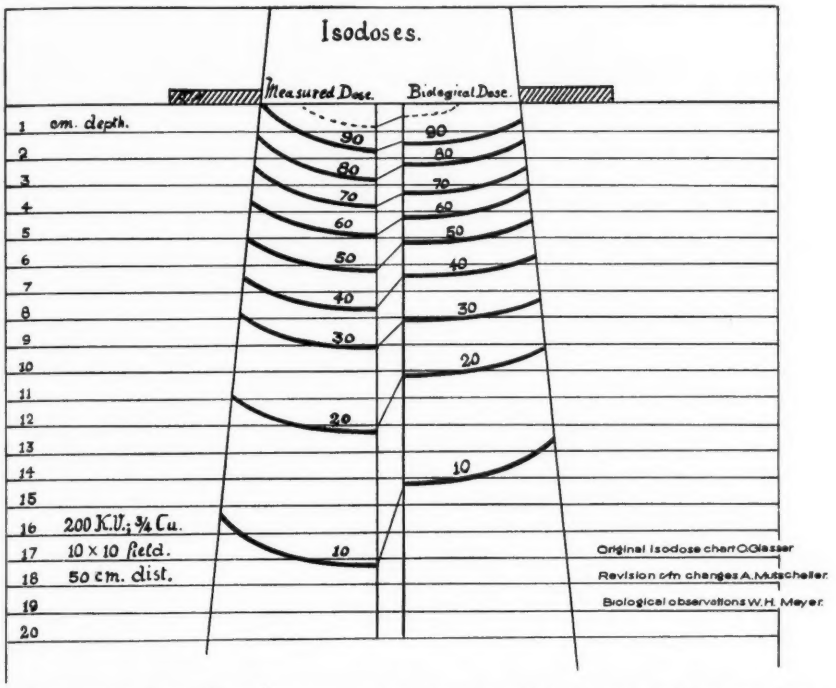
3. Excessive penetration obtained by too high voltage and over-penetration results in unnecessary damage to deeper lying tissues, which may have a sensitivity as great or greater than that of the lesion.

4. In small and medium sized parts over-penetration also results in an excessive exit dose, curtailing the efficiency of cross-fire.

5. The present inference is that improvement in depth dosage and effectiveness of radiation is to be sought not alone

in a *slower* rate or rhythm of dose administration but also by improved *cross-fire efficiency*.

cate absorption as it occurs in human tissue, will the dosage problem of radiation therapy be more thoroughly understood.



Quantitative Chart 17 represents an isodose chart in which the technical factors are the same as in Chart 16 excepting that the portal diameter is one-half as wide. The difference in isodose intensities is worthy of note. The half value layer here is fully a centimeter less than with the larger portal.

6. Whereas there may be but little disparity in the physically measured dose and biological radiation efficiency in the more superficially located lesions or even those included well within the first half value layer, our physical experiments and clinical observations indicate that in deep-seated lesions (especially those located beyond the first half value layer) fully *half again as many portals* for cross-fire must be employed than indicated by the present day isodose charts, if the same biological effectiveness is to be obtained as in the more superficially located or intermediate depth lesions.

7. Not until an instrument has been devised which will more reasonably indi-

DISCUSSION

From the discussions and many personal conferences, a few salient remarks have repeatedly appeared.

Firstly, in those radiotherapeutic installations where only one or two calibrated technics are employed, objection is raised to the complexities of the method we have presented.

In a plant where only deep-seated malignancies are treated, a limited technic may well be justified.

On the other hand, if one is dealing with lesions of different radiosensitivities, at various depths, in all sizes and age periods, then such a qualitatively limited technic would mean an utter disregard of the fact

that the *effective radiation* is not that transmitted but *that absorbed*. Granting that with a single technic similar good results in the treatment of superficial lesions if the least systemic effect and minimal depth damage is desired.

Comparative Table of various Quality Measures of Heterogeneous Radiation

½ mm Al.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
½ mm Cu.			.1		.2		.3		.4		.5	.6	.7	.8		.10		.12	.14	.16		.18	.20	.22	
½ cm. Water phantum.			1		2		3		4		5		6			7			8						
½ cm. Water pencil.						30			32		34			36			38		40			42			
% thru ½ mm Cu.			10		20		30		40		50			60			70					80			
% thru 1 mm Cu. (a)				10			20			30			40			50			60			65			
% thru 4 mm Al. (b)	10	20	30	40	50		60			70				80						85					
½ mm Cu = mm Al.						12		11			10			9			8			7				6	
1 mm Cu = mm Al. (c)						20		19			18			17			16			15			14		
λ eff. from (a)				.24			.22			.20			.18			.16			.14			.12			
λ eff. from (b)			.40	.36	.32	.30	.28		.26		.24		.22		.20	.18		.16	.14			.12		.10	
λ eff. from (c)						.21		.20			.19				.18	.175		.17				.16			.15			.14

Lines I and II are experimentally measured; thimble chamber protected against secondary rays. In all instances where radiation through Cu is measured, 1 mm Al is interposed with the ionization chamber 10 cm distant.

Line III. From isodose measurements with thimble chamber in large water phantom (large portal 20 × 20 cm.).

Note that the Al in X, XI, and XII are deducted from corresponding lines VI, VII, and IX, labeled respectively a, b, and c, and are read from Duane's curves.

Chart 18. A table of comparative quality measures, as prepared by Dr. A. Mutscheller, is herewith appended as an aid in translating the various physical data of different quality methods along with comparative phantom measurements. This is presented in the hope that it may be of as much service to the practical therapist as it has been to us.

We fully expect that slight differences in comparative tests by others will occur, due to certain technical variations. The present table differs somewhat from those formerly published by the author, mainly because scatter effects from the heavier filter metals have here been practically eliminated. The half value layers with the more penetrating rays, therefore, appear relatively higher. The table has also been extended in this direction. With lower voltage and little or no filtration, the half value layer in aluminum remains practically as heretofore.

various lesions can be obtained, still one would have to be most neglectful of possible damage to neighboring and deeper lying tissues, perhaps as sensitive or more so than the lesion, and forget the inhibitive effect on development and growth of young individuals.

I grant you that by changes in focal distance and the size of the area irradiated the various qualities employed for illustrative purposes may be made to blend one into the other. However, a glance at the charts reveals a wide range from the softest to the hardest radiation qualities, and it is evident to those who have the slightest desire to comprehend that a minimal of at least four quailty selections is essential.

1. A low voltage technic is required for the treatment of superficial lesions if the least systemic effect and minimal depth damage is desired.

2. In lesions relatively close to the surface, especially in infancy and childhood, the only way to stop criticism of radiation therapy in this type of case is by the careful selection of ray quality as well as by intensity control.

3. In lesions which are of intermediate depth, that is within the first half value zone, then will the maximum absorption therein be obtained with the least damage to deeper lying tissues, and the nearest to an ideal for cross-fire purposes.

4. For deep-seated lesions, there is but one choice, namely, within reason, the utmost of voltage and filtration that the installation can afford.

With regard to criticisms of our method of evaluating (by the half value) what

transpires in a water phantom, there is no need for apology. I would like to ask by what other method of illustration can a clearer concept of absorbed energy be demonstrated? Any absorption curve is in truth a measure of transmitted intensity, as is the so-called depth dose at 10 cm. Whether these measurements be through metals such as aluminum and copper or whether in a water phantom or other substance simulating human tissue, the fact remains that this is at present accomplished by an *air ionization* chamber and not by a substance similar to the absorbing medium. The more the voltage and filtration are changed and the greater the thickness of substance through which measurements are made, the greater is the variation of the r dose for any observed skin or biological reaction. Therefore, the statement that any fixed iontoquantimetric measure is an index of absorption in human tissue is but a fetish.

When one determines the half value layer, then within the limitations and errors of present-day instruments, one knows the depth or thickness of substance within which one-half the *energy* has been *absorbed*. This is the zone of maximum absorption within which the greatest effectiveness of radiation will be obtained. The much lesser absorption efficiency in the succeeding deeper zones is apparent.

There is no valid reason why a correlation of the half value layer in metals and that in a phantom substance should not be experimentally presented so long as all of the variables of size, focal distance, etc., are understood. By such correlation, a clearer concept of ray absorption in the human body is attained. Apropos of some criticism in this direction, one might well ask, of what use is physical qualitative and quantitative calibration if no correlation to practical clinical radiation therapy can be established?

With regard to the critics applying the word "unfortunate" to this and previous communications on the half value layer, I am inclined to agree that it is unfortunate that a closer relation between physical dose calibration and biological reaction has not been established. It is unfortunate that the iontoquantimeter is not the uniform biological dose standard some would have us believe it to be.

May I remind them that, irrespective of the opposition in certain quarters to my previous support of the half value layer as a quality measure, nevertheless this became the internationally accepted standard.

Again, when Glasser and I reported our observations on the influence of quality variations on the r dose in relation to skin (biological) reaction, efforts at refutation were made, yet to-day every experienced radiologist employs practically double the r dose with strongly filtered radiation than used with unfiltered. In this connection, might I remind my readers that even with 200 kv. and 0.5 mm. Cu filter, the radiation is still not homogeneous and since a water phantom or the human body of itself acts as a filter, a similar though perhaps less evident variation of the r dose in the deeper layers should result.

Finally, it is well that a free expression of thought is still permissible, and I am convinced that the material herewith presented, notwithstanding momentary opposition, will, perhaps with minor revisions, also finally be accepted.

REFERENCES

(1) COLWELL, H. A., RUSS, A.: Radium, X-rays and the Living Cell. Second Edition.
(2) DESJARDINS, A. U.: Jour. Am. Med. Assn., **105,** 2064, Dec. 21, 1935; 2153, Dec. 28, 1935.
(3) PACKARD, C.: Jour. Cancer Research, **13,** 1929.
(4-*a*) MEYER, W. H., and GLASSER, O.: RADIOLOGY, **6,** 320–325, April, 1926.
(4-*b*) MEYER, W. H., BRAESTRUP, C. B.: RADIOLOGY, **11,** 72–77, July, 1928.
(4-*c*) MEYER, W. H.: RADIOLOGY, **24,** 206–212, February, 1935.
(4-*d*) MUTSCHELLER, A.: RADIOLOGY (to be published).
(5) MEYER, W. H.: N. Y. St. Jour. Med., June 15, 1921.
(6) Idem: Arch. Pediat., September, 1921.
(7) Idem: N. Y. St. Jour. Med., Dec. 11, 1920.
(8) HOLTHUSEN, H.: Strahlentherapie, **46,** 273–288, 1933.
(9) GREBE, L., and NITZGE, K.: Tabellen. Urban & Schwarzenberg, 1930.

X-RAY RENTALS IN HOSPITALS

AN ANALYSIS OF CURRENT RENTAL COSTS IN HOSPITALS AND MEDICAL BUILDINGS

By L. HENRY GARLAND, M.D., *San Francisco, California*

THE Hospital Administrators' Creed (*Hospitals*, p. 22, May, 1938) enunciates these principles: "My first great duty is to serve the sick and the suffering" and "I should endeavor at all times to maintain a strong bond of co-operation and friendship with each and every one for the advancement of our work." Every hospital desires to have the most efficient medical staff it can obtain and desires to provide that staff with the most up-to-date equipment for the diagnosis and treatment of suffering humanity.

The question of the operation of the x-ray department has been a recurring one in recent years, owing partly to the development of group hospitalization, and partly to a growing concern on the part of thinking physicians as regards trends in the practice of medicine. How can a hospital handling private pay patients adequately meet the responsibility of arranging for proper x-ray service to its patients? In the opinion of those who have studied this problem thoroughly, the best way appears to be that which is followed in the development of any other medical service. The executive medical staff should select the physician or physicians whom they consider to be the best radiologists available, and appoint him or them on the hospital staff in the same manner as other physicians are appointed. He or they should then arrange with the hospital to secure adequate space, or space and equipment, for the practice of his specialty. This arrangement can be effected in one of the following simple ways:

1. The hospital can allocate to the x-ray department adequate floor space wherein the radiologist can conduct his practice, and for which he will pay to the hospital a fixed monthly sum.

2. The hospital may lease floor space and equipment to the radiologist and collect an adequate monthly rental therefor.

3. The hospital may collect a rental on the basis of a specific charge for each examination done. Such a rental can be arrived at by including all of the charges mentioned below, for a period of a year, and dividing it by the number of examinations made during that year. This will give a rental per examination basis. In actual practice, it could be arranged on the basis of the average number of case visits per month. (It will be based on floor space, interest on capital investment, allowance for depreciation and obsolescence of equipment, furniture and fixtures, plus such supplies, etc., as are furnished. Such a rental is based on the actual cost of operation.)

ADVANTAGES AND DISADVANTAGES OF A SYSTEM IN WHICH MEDICAL AND HOSPITAL SERVICES WOULD BE SEGREGATED

The following is a summary of the advantages and disadvantages of a system whereby hospital and x-ray services are segregated

To the Hospital

(*A*) It encourages the selection of the radiologist solely on the basis of competence, unbiased by any percentage or salary consideration to which he might agree.

To the Physician

(*A*) It places the appointment of the radiologist on the same professional basis as the other individual physicians on the staff, both ethically and legally.

(*B*) It removes all question of division of fees, practice of medicine by a corporation, and so forth.

(*C*) It excludes criticism of the hospital competing with outside physicians in the field of diagnostic and therapeutic medicine.

(*D*) It ensures a more competent type of radiological service without additional cost to the hospital. The department becomes increasingly a feeder to the hospital, because of the fact that a good radiologist builds up a clientele of his own and not only hospitalizes treatment patients of his own but attracts good physicians to hospitalize cases in the hospital.

(*E*) It removes from the hospital any question of suit for liability in connection with medical x-ray service and care.

(*F*) It gives the hospital a monopoly of the services of the radiologist.

(*B*) It removes all question of division of fees.

(*C*) It stimulates the hospital radiologist to build up his practice and thereby build up the hospital-bed occupancy on the proper basis.

(*D*) It places the responsibility for the operation of an efficient radiological practice where it should be placed, namely, with the physician.

(*E*) It places the economic status of the radiologist on a level comparable with that of his fellow-physicians, since he bills his private patients exactly as do other physicians.

(*F*) It gives the radiologist a monopoly of the practice in the hospital, except in the case of those patients who desire an outside radiologist to examine them, or in the case of those physicians who request the consultation services of an outside radiologist.

RENTABLE AREA IN A HOSPITAL

What is the amount of rentable area needed for an adequate x-ray department, and what rate should be charged by the hospital for this area? The answer to the first question is easily solved by joint consultation between the radiologist and the administrator, depending upon the type of hospital and the amount of teaching done. It can be estimated quickly from tables already prepared by, and available from, the American College of Surgeons and the Rockefeller Foundation.

What rental rate should be charged by hospitals? An interesting discussion of this phase of the problem was recently presented in *Hospitals* by an eminent administrator from Southern California (*Hospitals*, p. 28, May, 1938). He came to the conclusion that the rental rate should be approximately *three times* that charged by a Class A medical building for a similar amount of floor space. We propose to analyze the reasons for those conclusions and determine whether or not they are sound.

To help us solve this problem, we consulted the administrators of two of the largest private hospitals and the superintendents of two of the largest medical buildings in a city of 700,000 population. A summary of their findings is shown in Table I.

TABLE I

	Medical Office Building	Hospital Building
Total *service* area.....	20%	40%
Total *rental* area.....	80%	60%
Rate of rent per sq. ft. annually.....	$2.00–$3.00	$2.10–$3.13
Cost per sq. ft. annually.	$1.30–$1.45	$1.50–$1.86

ADMINISTRATION EXPENSE IN A MEDICAL OFFICE BUILDING

The administration expense or overhead in a medical office building includes the following items: administration expense, housekeeping, engineering expense, including heat, light, and power, maintenance and

repairs to building, elevator operation, insurance, taxes, depreciation, 4.5 per cent on indebtedness, accounting department, billing, bookkeeping, and collections.

It is to be remembered that the cost of ground rent is enormously higher in the case of a medical office building than it is in the case of a hospital, since most medical office buildings are located in expensive downtown rental areas. Further, taxes are much higher in the case of the average large medical building. The following are actual operating expenses *per square foot per year* for a medical building; they will vary up or down approximately 10 per cent, from one building to another.

TABLE II

1. Variable Operating Expenses

(*a*)	Cleaning	0.2550	
(*b*)	Elevator Service and Power	0.1200	
(*c*)	Lighting and Electric System	0.0590	
(*d*)	Heating and Ventilating	0.0399	
(*e*)	Water and Plumbing System	0.0545	
(*f*)	Alterations and Repairs	0.0638	
(*g*)	Administration and General Expense	0.1342	0.7284

2. Fixed Charges

(*a*)	Taxes	0.2275	
(*b*)	Insurance	0.0424	
(*c*)	Interest on Investment	0.0400	
(*d*)	Depreciation—1.75 per cent on Building, 25 per cent Autos, 10 per cent Machinery, Furniture, and Fixtures	0.3900	0.6999
			1.4283

ADMINISTRATION EXPENSE IN A HOSPITAL BUILDING

The administration expenses or overhead in a hospital building include the following items: administration expense, housekeeping, engineering expense, including heat, light, and power, maintenance and repairs to buildings, elevator operation, insurance, taxes, depreciation, from 3 to 4.5 per cent on indebtedness, accounting department, billing, bookkeeping and collections, telephone switchboard service.

The following is an estimate of the rental value of the space occupied by an x-ray department in a private hospital of 165 beds.

The hospital on which these figures are based has 79,000 feet of floor space. Of this total, 20 per cent is occupied by hallways and elevators and 20 per cent by utility rooms. Only 60 per cent of the space is income-bearing. Of this income-bearing space, the x-ray department occupies approximately 10 per cent.

The expenses incurred in operating the part of the building allocated to the x-ray department, including all general operating expenses pertinent thereto, are listed in Table III.

TABLE III

Depreciation		
This particular hospital is being written off at the rate of 5 per cent per annum, and since the original cost was $500,000 the total depreciation per year is $25,000. This amounts to a yearly cost of 0.316 per sq. ft. Since the x-ray department occupies 5,000 sq. ft., its portion of this cost is.....	$1,580.00	
However, the x-ray department must also bear its portion of this cost in connection with the space occupied by halls and elevators. The halls and elevators take up 15,800 sq. ft. The amount multiplied by the cost per sq. ft. is..... $4,992.80 Since the x-ray department represents 10 per cent of the income-earning space of the hospital, it should bear 10 per cent of this cost or.....	$ 499.28	
Total depreciation cost to the x-ray department.....		$2,079.28
Insurance Cost		
The total building insurance cost for one year is $2,000 or 0.025 per sq. ft. 5,000 sq. ft. × 0.025 is....	125.00	
15,800 sq. ft. × 0.025 is..... $395.00		
$395.00 × 10 per cent is...	39.50	
Total insurance cost to x-ray department is.....		164.50
Elevator Expense		
Total elevator expense for the year is..... $4,687.10 Assessment from x-ray department 10 per cent.....		468.71
Building Maintenance		
The yearly cost of building maintenance is $9,110.15 or 0.115 per sq. ft. The cost of x-ray department is 5,000 sq. ft. × 0.115 or.....	575.00	

The portion of the building maintenance in respect to halls and elevators is as follows: 15,800 sq. ft. × 0.115..... $1,817.00		
$1,817.00 × 10 per cent...	181.70	
Total building maintenance cost to x-ray department.....		756.70
Heat, Light, and Water		
The yearly cost of this is $7,340.74 or 0.093 per sq. ft. The cost of the x-ray department is 5,000 sq. ft. × 0.093.....	465.00	
The proportionate cost of the halls and elevators is 15,800 sq. ft. × 0.093..... $1,469.40		
$1,469.40 × 10 per cent...	146.94	
Total cost of heat, light, and water to x-ray department		611.94
Telephone, Switchboard Service		
Total telephone expense for the year is $12,278.09. In the hospital there are 136 telephones. In the x-ray department there are 11 telephones; hence, the x-ray department should bear $^{11}/_{136}$ of this cost or.....		912.20
Housekeeping		
I have taken an arbitrary figure of $100.00 per month which includes the services of one porter and supplies.....		1,200.00
Administrative Expense		
This figure is also arbitrary since it is obvious that an independent x-ray department would not be subject to the large administrative expenses of a hospital.....		600.00
Interest on Investment		
At 5 per cent.....		2,500.00
Total Cost of Space Occupied by X-ray Department.....		9,293.33
Cost per sq. ft. per year....	1.86	

The above figure of $1.86 does not include taxes (to which the particular institution on which my figures are based is not subject), laundry or linens, equipment, stationery, collection of accounts, or profit on investment.

If the profit on investment is figured to correspond with the profit made by the medical building portrayed in Mr. Heerman's article, the rental value per square foot would be: $1.48 : $2.49 : : $1.86 : $X

$X = $3.13 per square foot.

Thus the annual rental due from the x-ray department, which occupies 5,000 square feet, would be $16,150.00 or $1,345.83 per month. The percentage of profit in the case of the medical building is 60 per cent, which I believe is too high. The x-ray department in the hospital considered shows a mark-up of 20 per cent. This would result in a rental value of *$2.30 per square foot*, which would amount to a yearly rental of $11,500 or approximately $960.00 per month, which I believe is nearer to the mark.

HOW TO COMPUTE RATE FOR RENTAL OF SPACE IN A HOSPITAL

Rental rate in a hospital may be computed on a basis of the cost for an equivalent space in a medical building in the locality of the hospital, or on a basis of the return the hospital would receive were it to allocate such space for the main hospital function, namely, bed space. In computing the rental according to the first formula, it is to be remembered that the addition of an x-ray department to a hospital does not increase the following service charges: diet kitchen, laundry, pharmacy, surgery, nursing, interne service, medical record keeping, etc. Therefore, in estimating the proper rental rate for an x-ray department it is neither fair nor sound accounting to take into consideration all of those factors which must go on irrespective of the presence or absence of an x-ray department (and actually do go on in many hospital institutions where no x-ray facilities are available or needed).

In estimating the rental on a basis of the amount recoverable by the hospital if a similar amount of floor space were allocated to bed service, it is to be remembered that allowance should be made for the location in which the x-ray department happens to be. It is quite possible that in some hospitals, where the x-ray department is located on a choice upper floor near the operating rooms, a relatively high income from private room bed space could be earned by the hospital, were such space turned over to beds and not x-ray de-

partment. Conversely, in other hospitals, where the x-ray department is located in the basement, such an area would be of relatively low income-producing power as far as bed space is concerned, since, if allocated at all, it would be to some sort of ward accommodations.

CHARITABLE STATUS OF HOSPITALS IN RELATION TO ANY TYPE OF RENTAL ARRANGEMENT

Many charitable hospitals have been built by public funds and many by a combination of private and public funds. Many charitable hospitals handle only charitable cases, but some handle a large volume of private pay patients. Can a hospital administrator justify his stewardship if he fails to seek and provide for the best type of radiological service obtainable? There is no question but that the straight rental of space for an x-ray department will decrease the cost to the sick. A straight rental arrangement will eliminate the need for duplication of bookkeeping, and dual allocation of net income. A straight rental contract encourages provision of the highest type of radiological service and will never jeopardize the status of any non-profit corporation. Since a corporation cannot and does not wish to practise medicine, government agents will be more than pleased with an arrangement which clarifies the distinction between hospital and medical service, that is, a rental type of arrangement.

CONCLUSION

Hospitals assist the physician in caring for the sick of the community. Progressive hospitals attract to them the highest type of medical talent available. Diagnosis is the cornerstone of modern medical care, and therefore there are few departments in a hospital of greater importance to the patient than the diagnostic departments. The basis for the conduct of private practice in those diagnostic departments should be the same as the basis for the conduct of private practice in the general surgical or medical departments. Private patients should be billed by the radiologist just as they are by the surgeon or the internist. It is up to the radiologist to take the same chance as his colleagues on collecting his bill, and, within similar limits, to provide adequate medical service for patients referred to him, irrespective of income. Where mutual respect and good feeling prevail, the quality of radiological service is far superior to that rendered under less pleasant circumstances. Hospitals do not wish to exploit competent radiologists, nor do conscientious radiologists wish to exploit hospitals. The rental plan is the most efficient and least complicated plan whereby the hospital can recover its costs involved in a radiological department, and the radiologist can practise radiology to the best advantage of the patient. The welfare of the patient is served best by this type of arrangement.

MULTIPLE HETEROMORPHOLOGIC MALIGNANT TUMORS OF THE UTERUS

By HAROLD W. JACOX, M.D., GLENN MAJOR, M.D., *and* MARGARET R. BAKER, M.D., *Pittsburgh, Pennsylvania*

From the Western Pennsylvania Hospital

IN spite of the fact that mortality statistics rank malignancy as one of the leading causes of death, the incidence of multiple malignant tumors in the same individual is comparatively rare. Cases in which three morphologically dissimilar tumors occur are regarded as curiosities. The case herewith presented illustrates the occurrence of three such malignant tumors of the uterus.

Billroth (1) is credited with the first report on multiple primary malignant growths in the same individual. He emphasized the importance of certain basic criteria before the diagnosis of such a condition could be established. His postulates are as follows: (1) each tumor must have an independent histologic appearance; (2) the tumors must arise in different situations, and (3) each tumor must produce its own metastasis. Mercanton added a fourth prerequisite—that there be no recurrence of the tumors following their removal. The demand for the fulfillment of the third postulate of Billroth, as well as that of Mercanton, is quite as unreasonable in the diagnosis of multiple primary malignancy as in that of a single carcinoma. In the latter case, to diagnose malignancy only in the presence of metastasis would create a deplorable situation. Hurt and Broders (9) and Hanlon (8) felt that the criteria advocated by Goetze are reasonable, and were fulfilled in their cases. They are: (1) the tumors must have the macroscopic and microscopic appearance of the usual tumors of the organs involved; (2) exclusion of metastases must be certain, and (3) diagnosis may be confirmed by the character of the individual metastasis. Burke (2) believed that the reasonable criteria for the diagnosis of multiple primary cancers are: (1) each tumor must be distinct in morphology; (2) must present a definite histologic picture of malignancy, and (3) must not represent a metastasis.

There is considerable difference of opinion as to the incidence of multiple primary malignant tumors in the general cancer population. The work of Warren and Gates (14) is particularly noteworthy in this respect. They collected 1,259 such cases, including 40 of their own. Based on statistics of all the reviewed cases, they found that the frequency of multiple malignancy in cancer patients was 1.84 per cent; on the basis of American statistics it was 3.9 per cent, and in a series of 1,078 autopsies at their clinic the incidence was 3.7 per cent. Counseller and Butsch (4) reviewed the incidence of multiple primary malignant tumors in various series of cases reported and found that the percentage varied from 0.5 to 5.2. Burke (2) reported a series of 46 cases of multiple malignancy, with an incidence of 7.8 per cent—the highest reported in the literature.

If we are to place much reliance on the so-called "general cancer-producing factors," we might consider that an individual affected with one malignant tumor would be fertile soil for the development of other dissimilar tumors. Thus, Warren and Gates (14) and Burke (2) felt that multiple malignant tumors occur more frequently than can be explained on the basis of mere chance. Lund (10), in a statistical study, found that the development of cancer in some other organ in individuals suffering from cancer of the buccal mucosa is about twice as common as it is in the general population of like sex and age. Bugher (3), in a statistical study, found that the actual incidence of multiple primary malignant neoplasms exceeds that to be expected from chance alone. He explained this by stating that the risk of acquiring cancer is not spread uniformly over the entire popula-

tion, but only over some large portion of it. Cancer morbidity and mortality rates based upon this reduced population would give a frequency of coincidental cancer in agreement with that found to occur in fact. Ewing (5) stated that the rather common occurrence of two or more tumors in different organs of the same individual suggests nothing more than the accidental coincidence in several organs of the general etiologic factors in the genesis of tumors.

Fried (6), in discussing the rarity of multiple primary malignant tumors, gave as the reasons for this infrequence: (1) an individual with a malignant growth possibly succumbs to his disease before another malignant tumor develops, and (2) a possible state of immunity is conferred by the first malignant tumor. This belief is based on the experimental work of Jensen and of Ehrlich, which tended to show that in mice the transplantation of one malignant tumor confers immunity against a second transplantation in most instances.

Ewing (5) believed that the local condition occasioned by the presence of one tumor may be causative in the development of a second tumor, as in the case in which a submucous fibroma causes ulceration, which is followed by cancer of the uterine mucosa. The relative importance of the local and general factors in cancer genesis awaits solution, however.

The co-existence of sarcoma and carcinoma in the same individual is even more unusual than the presence of two dissimilar carcinomas. In a series of 307 cases of multiple primary malignancy observed by Schreiner and Wehr (12), sarcoma was observed in only six cases.

Multiple tumors of the same type in paired or symmetrical organs is a special case of multicentric growth, such as in carcinoma of both breasts, teratoma of both ovaries, or lymphosarcoma of both testes. Another special case of multiple tumor growth is observed in independent tumors arising simultaneously in organs which are functionally related, as in co-existent tumors of the breast, ovary, and uterus. There is ample evidence to indicate that the incidence of multiple tumors in paired organs, and in functionally related organs is greater than the normal expectancy.

Multiple malignant tumors of the same organ, according to Counseller and Butsch (4), is much more rare than the incidence in different organs. One notable exception to this statement, however, is seen in the case of the skin. In a series of 1,773 rodent ulcers observed at the Radium Institute, London, Ward (13) found 5.3 per cent to be multiple. In a case collected by Warren and Gates (14), a woman 50 years of age suffered from 251 different epitheliomas of the basal-cell type. Other organs affected by multiple malignant tumors, in the order of frequency, are the large intestine, the pharynx, and the stomach.

The ratio in which males and females are affected varies in different series of cases. It seems probable that the age incidence of multiple primary malignant tumors is about the same as for a single tumor of the same type, although some authors feel that the age in the case of multiple tumors is somewhat higher.

Whereas two dissimilar malignant tumors occurring simultaneously in the same individual is a rare occurrence, the presence of three or more such tumors is most unusual. Warren and Gates (14), in a very exhaustive review of the literature, were able to collect only 111 such cases.

The occurrence of two dissimilar carcinomas in the same uterus constitutes an extremely rare finding, according to Counseller and Butsch (4) who report two such cases; Goldstine (7) reports one, and Major (11) collected 12 cases of this type and added one of his own. The latter author also collected from the literature 12 cases in which a carcinoma and a sarcoma coexisted in the same uterus, and 11 cases of so-called carcinosarcoma.

In the literature we have not been able to find a case similar to the one herewith presented, in which a fibrosarcoma, an adenocarcinoma, and a squamous-cell carcinoma were present.

Case Report.—Mrs. A. O. B., 65 years of age, housewife, was admitted to the West-

ern Pennsylvania Hospital Jan. 14, 1938, with the complaint of scant vaginal bleeding of two weeks' duration.

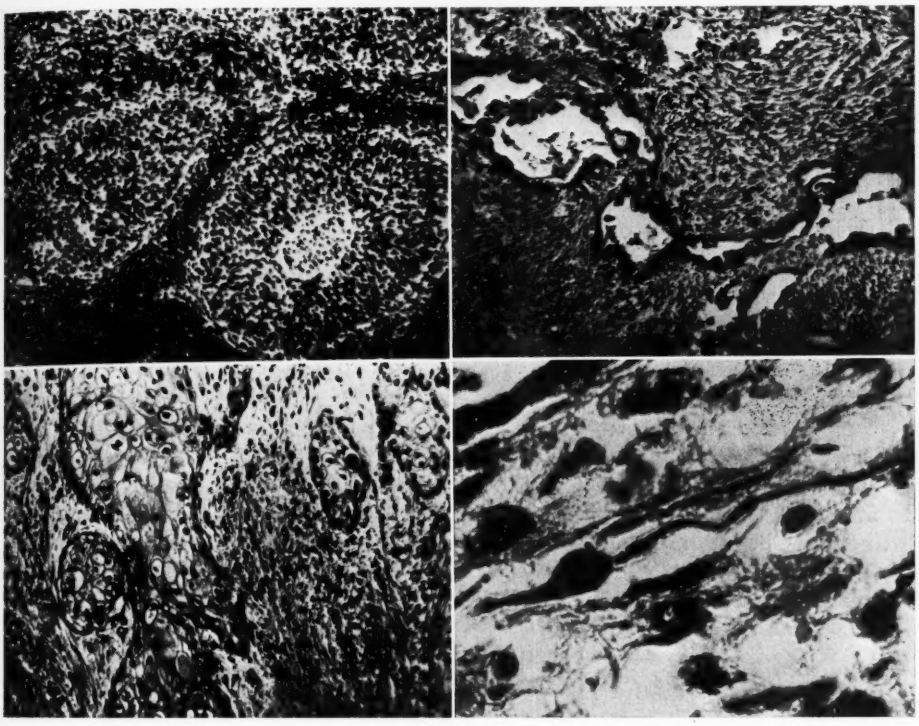


Fig. 1 (*upper left*). Squamous-cell carcinoma of cervix, poorly differentiated. Occurred 16 years before present group of neoplasms (hematoxylin and eosin: × 170).

Fig. 2 (*upper right*). Field from papillary tumor of lower uterine segment, showing adenocarcinoma and fibrosarcoma (hematoxylin and eosin: × 115).

Fig. 3 (*lower left*). Another field from the same tumor as Figure 2, showing the squamous-cell carcinoma (hematoxylin and eosin: × 150).

Fig. 4 (*lower right*). Fibrosarcoma. In one of the large neoplastic cells are seen very definite fibroglia fibrils (phosphotungstic acid hematoxylin: × 1700).

The history of this patient is particularly interesting. In 1922 she was treated elsewhere. At that time her complaint was profuse vaginal discharge without bleeding. The uterus was said to have been freely movable. The cervix presented a cauliflower-like mass that completely surrounded that structure. Biopsy was done and the section showed a small piece of uterine cervix, most of which was infiltrated by solid masses of epithelial cells disposed in large, irregularly shaped islands separated by a small amount of stroma. The cells varied from polygonal to spindle in shape and had no definite arrangement except for a more or less well-defined basal layer of spindle cells. The cytoplasm was pale and ill-defined. The nuclei were hyperchromatic and showed great diversity in size and shape. Mitotic figures were numerous. The diagnosis was squamous-cell carcinoma of the cervix, which was poorly differentiated. The cervix was destroyed with the actual cautery, and six days later 25 mgm. of radium was inserted for six hours into the cervical stump. One year later, because of persistence of the leukorrhea, 50 mgm. of radium was inserted into the cervical stump for twelve hours, and again six months later she received a similar amount of irradiation. The vaginal

discharge subsided, and although she was examined at frequent intervals, there was no clinical evidence of recurrence of uterine malignancy. The uterus remained freely movable, despite the irradiation.

On Dec. 26, 1937, the patient fell and sustained a minor injury of the right thigh. One week later she noted the onset of slight vaginal bleeding which continued for six days, the quantity being that of a scant menstrual period. Subsequently there was no further bleeding. The patient was cancer-conscious because of her past history, and consequently presented herself for study. There had been no weight loss, or other symptoms.

The family history indicated that one sister died of cancer of the breast and one brother died of cancer of the stomach.

On examination the patient was found to be in an excellent state of nutrition; there was no pallor of the skin or mucous membranes, the pulse rate was 80, the temperature was 98.3 degrees, and the blood pressure was 160 systolic and 86 diastolic. No abdominal masses were palpable, there was no abdominal tenderness, and no rigidity. On vaginal examination the uterus was found to be slightly enlarged (probably 20 per cent larger than normal for her age); it was freely movable. The fundus did not appear to be attached to surrounding structures and it was symmetrical; there was no induration of the broad ligaments, and the cervical stump presented no areas of erosion or ulceration. On rectal examination no masses could be palpated.

The examination of the blood showed 3,850,000 red cells per cubic millimeter, 6,800 white cells per cubic millimeter, hemoglobin 80 per cent (Sahli). The urine presented no abnormality and the blood Wassermann was negative.

On Jan. 15, 1938, curettage of the uterine cavity was performed and considerable friable material was thus removed. The microscopic diagnosis of the curettings was adenocarcinoma and fibrosarcoma. On Jan. 19, 1938, the patient was given 500 c.c. of citrated blood. The following day a total abdominal hysterectomy was performed. The abdomen was opened through a low midline incision. The uterus was found to be slightly enlarged, it was freely movable, symmetrical, and was not adherent to surrounding structures. The uterus, together with both ovaries and tubes, was removed. As the operation was carried down to the cervix the line of dissection was kept at some distance from the cervix itself, thereby removing considerable parametrium.

The patient made an uneventful recovery. On Feb. 1, 1938, roentgen irradiation was instituted and was continued throughout the next two weeks, at which time the patient was discharged.

She received a total of 1,600 r (measured in air) to each of four portals, 12 × 17 cm. in size, about the pelvis, within a period of 16 days. This was given at the rate of 200 r per portal, and after the first treatment two portals were given daily, except Sunday, alternating the anterior and posterior oblique fields. The following factors were used: 200 kv. constant potential, 6 ma., 50 cm. target-skin distance, 0.5 mm. copper plus 2 mm. aluminum with an intensity of 18 r per minute. The treatments were discontinued when the patient developed a definite erythema of the skin of the portals treated and mild diarrhea. There was no radiation sickness.

A check-up examination five months after the operation showed no evidence of neoplasm, but slight pigmentation of the treated areas. The patient was in perfect health.

Pathological Description.—The curettings consisted of four irregularly shaped, ragged pieces of yellowish-white, friable tissue, each about 3 × 4 × 7 mm., and some clotted blood containing fragments of similar tissue.

The uterus, including cervix, measured 3.5 × 6 × 9 cm. Both adnexæ were attached and appeared grossly normal. The vaginal surface of the cervix was smooth and the cervical canal was wide. The myometrium was 1.5 cm. thick. The endometrium was thin, pink, and ragged. In the lower uterine segment was a rather firm,

coarsely papillary, yellowish-pink mass approximately 1 cm. in diameter. Cross-sections at this point showed no gross lesion of the underlying myometrium.

Microscopically, the curettings appeared to be parts of a coarsely papillary mass, the external surface of which (except for extensive areas of ulceration) was covered with simple columnar epithelium, which in one area was replaced by non-keratinizing squamous epithelium. Both types of epithelium were seen invading the underlying tissue.

The invading glands varied in size and shape and were lined by one or more layers of columnar epithelial cells with dirty pink or colorless cytoplasm and oval, vesicular nuclei. The cells were frequently disoriented, occasional nuclei showed variations in size, shape, and staining intensity, and mitotic figures were exceedingly numerous. Some groups of cells showed an even greater diversity of appearance and instead of forming glands they grew in solid masses. There were also glands which were lined partially by columnar, and partially by squamous epithelium, and were associated with islands of squamous epithelium of similar appearance. They were characterized by a basal layer of small cuboidal cells and a central mass of large, pale, polygonal cells with occasional evidence of prickle formation. These undoubtedly represented a metaplasia of the columnar epithelium.

There were, however, islands of squamous epithelium which could be seen to have arisen directly from the portion of the papillary mass covered by that type of tissue. This epithelium was very well differentiated with a basal layer of small cuboidal cells, an intermediate layer of large prickle cells with deep pink cytoplasm, and frequently with a central mass of keratin. The cells varied in size and shape, were irregularly oriented, and showed a few mitotic figures.

The stroma invaded by these two types of epithelium was highly cellular and made up the bulk of each piece. Its cells were somewhat loosely arranged and of exceedingly diverse appearance. In many areas they were predominantly spindle-shaped and tended to lie parallel to each other in narrow interlacing bands, while in other areas they were irregularly polygonal or spindle-shaped, and lacked any definite arrangement. The most striking feature was their variability in size, some of the cells being very small, while others were practically giant cells. The cytoplasm of the large and medium-sized cells was usually deep pink. The nuclei were oval, spindle-shaped, or slightly lobed and frequently hyperchromatic. Mitotic figures were numerous, especially in the larger cells.

These cells occasionally showed a somewhat superficial resemblance to some of the epithelial cells, but there were no instances of transition between the two. Furthermore, phosphotungstic acid hematoxylin stains showed blue fibrils in all these cells. These fibrils were very thick with nodular enlargements and usually only one was seen in each cell so that it was difficult to determine whether they were fibroglia or myoglia fibrils. In a few instances, however, they were definitely identified as fibroglia fibrils. There was a fair amount of scattered reticulum and narrow strands of collagen fibers in the tissue.

The papillary mass remaining in the uterus resembled the tissue seen in the curettings, except that the majority of the epithelial elements were well differentiated squamous epithelium, disposed in several large islands surrounded by numerous medium-sized and very small nests of the same cells which were invading the stroma on all sides. Only a few glands were present and they were small and near the surface, but they showed disorientation of nuclei and the presence of many mitotic figures. The highly variable stroma cells again made up the bulk of the tissue.

Neither the stroma nor the epithelial masses invaded the underlying myometrium, but occasionally the curetted surface of the endometrium, at some distance from the papillary mass, showed a few

large, spindle-shaped cells with variable, hyperchromatic nuclei resembling those seen in the stroma. The cervical wall contained a number of areas of dense hyalinized fibrous tissue, but showed no evidence of neoplasm.

Diagnosis.—Adenocarcinoma of the body of the uterus, partially differentiated. Squamous-cell carcinoma, well differentiated. Fibrosarcoma, partially differentiated.

The first diagnosis on the curettings was fibrosarcoma and adenocarcinoma, since the islands of squamous epithelium were thought to be due to metaplasia of the adenocarcinoma. Later on it was realized that the majority of the neoplastic squamous epithelium had an independent origin from squamous epithelium covering one part of the papillary growth, the metaplasia having preceded the neoplastic change.

DISCUSSION

This case presents several points of interest. The squamous-cell carcinoma, for which the patient was treated sixteen years prior to her present admission, was cured, according to our present standards for the evaluation of such data.

The three different malignant tumors which later appeared in her uterus all apparently arose in a papillary polyp of the endometrium. The location of all three neoplasms in one small area suggests the possibility that there may have been some local condition present which was acting as the inciting factor of malignant change in a cancer-susceptible individual.

Since the origin of the two carcinomas was evidently from the covering epithelium of the polyp there can be no possible relationship between them and the earlier carcinoma. No evidence of neoplasm was found anywhere in the cervix. It is realized that the adenocarcinoma and squamous-cell carcinoma might possibly be considered as one tumor, since both arose from the epithelial covering of the same papillary mass, but we feel it is justifiable to consider them as two separate tumors.

Should this patient have received pre-operative irradiation? In the light of the final diagnosis such treatment would have been indicated, but in the biopsy material the squamous-cell carcinoma was not recognized as an independent tumor. Although differences of opinion exist on the question of the pre-operative irradiation of uterine adenocarcinoma and fibrosarcoma, we were of the opinion that it was not justified in this case.

SUMMARY

A case is presented in which three dissimilar tumors were found in the uterus. The combination of tumors was: adenocarcinoma, squamous-cell carcinoma, and fibrosarcoma. Surgical and radiation therapy produced highly satisfactory results.

4800 Friendship Avenue

BIBLIOGRAPHY

(1) Billroth: Quoted by Hanlon and by Counseller and Butsch.

(2) Burke, M.: Multiple Primary Cancers. Am. Jour. Cancer, **27,** 316–325, June, 1936.

(3) Bugher, J. C.: The Probability of the Chance Occurrence of Multiple Malignant Neoplasms. Am. Jour. Cancer, **21,** 809–824, August, 1934.

(4) Counseller, V. S., and Butsch, W. L.: Double Malignant Tumors of the Uterus. Am. Jour. Obst. and Gynec., **31,** 628–633, April, 1936.

(5) Ewing, James: Neoplastic Diseases, p. 37. W. B. Saunders Co., Philadelphia, 1928.

(6) Fried, B. M.: Primary Double Cancer. Arch. Path., **5,** 565–576, April, 1928.

(7) Goldstine, M. T.: Squamous-cell Carcinoma of Cervix: Adenocarcinoma of Fundus of Uterus. Am. Jour. Obst. and Gynec., **30,** 137–139, July, 1935.

(8) Hanlon, F. R.: Multiple Primary Carcinomas. Am. Jour. Cancer (supp.), **15,** 2001–2012, July, 1931.

(9) Hurt, H. H., and Broders, A. C.: Multiple Primary Malignant Neoplasms. Jour. Lab. and Clin. Med., **18,** 765–777, May, 1933.

(10) Lund, C. C.: Second Primary Cancer in Cases of Cancer of the Buccal Mucosa: A Mathematical Study of Susceptibility to Cancer. New England Jour. Med., **209,** 1144–1152, Dec. 7, 1933.

(11) Major, R. H.: Multiple Primary Malignant Tumors. Johns Hopkins Hosp. Bull., **29,** 223–231, 1918.

(12) Schreiner, B. F., and Wehr, W. H.: Multiple Primary Cancer as Observed at State Institute for the Study of Malignant Disease. Am. Jour. Cancer, **20,** 418–424, February, 1934.

(13) Ward, R. (London): Radium Treatment of Epithelioma of the Skin. British Med. Jour., **2,** 511–513, Sept. 27, 1930.

(14) Warren, S., and Gates, O.: Multiple Primary Malignant Tumors: A Survey of the Literature and a Statistical Study. Am. Jour. Cancer, **16,** 1358–1414, November, 1932.

RESEARCHES IN THE PROBLEM OF RADIUM POISONING AND THE TOLERANCE DOSE OF RADIUM[1]

By PROF. B. RAJEWSKY, *Frankfurt-am-Main, Germany*

TRANSLATION BY EDITH H. QUIMBY, M.A., MEMORIAL HOSPITAL, NEW YORK CITY

EVERYTHING surrounding living organisms is radio-active. The earth's crust, all natural waters, actually even metals prepared in technically pure form, all contain larger or smaller admixtures of radio-active substances. It is obvious, therefore, that the tissues of living beings must also contain radio-active materials. They are taken into the body with the food, the drinking water, and the inhaled air, and are there deposited. The orders of magnitude of such normal radio-active deposits are shown in Table I. We have undertaken systematic determinations of the normal radio-active content of various body tissues. The carrying out of such measurements is relatively difficult, since they are concerned with quantities of the order of magnitude of 10^{-12} to 10^{-13} grams of radium element. In Table II are given the values thus far obtained (according to A. Krebs).

The more recent investigations show that the distribution of the radio-active material in the body is not homogeneous. In general, the bone tissues (bone marrow and bone cortex) show the greatest activity. Lungs, liver, spleen, and brain follow, some distance from bone, while muscle tissue shows decidedly less activity. It would be of interest to estimate, at least approximately, the biological effect of this normal activity of the body. Unfortunately there is no definitely known reference point. The only information of this sort available at the present time is regarding the so-called "tolerance dose" in roentgen and radium therapy, which is about 0.04 r per hour. On a basis of the known ionizing action of roentgen or radium rays it is possible to calculate the amount of radio-active material which would give this dose if deposited in the body. This is found to be about 6 micrograms (6×10^{-6} grams) of radio-active material for the human body. This exceeds the natural activity of the tissues about four hundred times, and we shall see further that the accumulation of such a quantity of radium in the body results in severe injury to the organism. The most important conclusion to be drawn from this fact is that the *internal* application of radio-active substance produces much more marked results than its *external* application. Ever since the discovery of radio-activity, attempts have been made to administer these substances internally for therapeutic purposes. The amounts of radium recommended for such treatments were given first as 1 milligram, later as 0.5 milligram. It is important to note that this is an amount of radium 33,000 times the normal body content, and eighty times the tolerance dose given above. Frequent favorable effects of such treatments are on record. In sharp contrast to this is the fact that, in an already considerable number of cases, fatal poisoning has resulted from the deposit of radio-active material.

If one considers the problem of radium poisoning as a whole, the following basic points present themselves: (1) The retention and elimination of radio-active substances by the body; (2) the distribution of the retained radio-active material within the body, with distinction between the portions remaining a short time and a long time; (3) the tolerance, or the toxic, dose of radio-active material; (4) the mechanism of the toxic effect of the radio-active material thus introduced; (5) therapeutic measures, of which the first is the question of the possibility of the removal of the toxic substance. The relative rarity of

[1] Presented before the Fifth International Congress of Radiology, at Chicago, Sept. 13–17, 1937.

radium poisoning, although a fortunate circumstance, makes the study of the problem a difficult one. For this reason all known cases of such poisoning are of the greatest importance. A further handicap is the fact that it is not always possible to subject these cases to the desirable thorough physical examination. Since, during the last few years, we have had the opportunity of investigating several cases of radium poisoning, it seems worthwhile to present the facts which have been ascertained. I will, therefore, discuss in detail two cases, one which showed lung fibrosis as the result of radium poisoning, the other which developed bronchial cancer from the same cause.

In the first case (a 24-year-old laboratory technician in a radium plant, who had been occupied for about three years with the preparation of radio-active materials and especially with luminous paint), death supervened about two years after the appearance of the first symptoms, which consisted of dyspnea and weakness. The blood picture was normal, even in the acute stages of the disease; the principal changes were in the lungs. These lung changes consisted in diffuse induration, with spots of fibrous hepatization and cornification. The pulmonary artery showed medial fibrosis, the bronchial, muscular hypertrophy with widening of the lumen. The pleura was likewise thickened and fibrous.

In the second case (a 34-year-old employee in the same radium plant), death came after about eleven years of occupation with radio-active materials. The patient had worked at first with strong preparations, and had sustained a burn on the chest and neck, which, however, had healed. Later she was employed in the separation of weak preparations. The clinical diagnosis was: "Left-sided bronchial cancer, arising in the bronchus of the left lower lobe, with marked infiltration of the whole hilus and the neighboring lymph node groups. Continuation along the trachea up to the larynx and into the tracheobronchial, jugular, and cervical lymph nodes, infiltration into the pericardium and retroperitoneal nodes, multiple metastases to the liver, marked skeletal metastases, also metastases to the ovaries and the adrenals. Marked general anemia, especially of the brain, strongly anemic fatty liver. Gelatinous condition of the bone marrow. Diffuse and spotty fatty degeneration of the myocardium. Marked relaxation of the heart muscle. Ecchymosis of the endocardium of the left ventricle. Softening and moderate swelling of the spleen. Intense edema of the left lung with exclusion of air, left-sided hydrothorax (300 c.c.); marked terminal edema of the right lung. Moderate chronic hypertrophic catarrh of the stomach. Ecchymosis of the fundus. Incomplete separation of the middle lobe of the right lung from the upper lobe, pedunculated polyp of the sigmoid, small fibroma of the right kidney. Section through the spinal cord was completely normal."

We investigated both cases for radioactive deposits in the body. In the first case it was possible, a few weeks before death, to make tests on the exhaled air and on the urine. After death, the various organs (spine, femur, rib, lung, spleen, heart, liver) were tested for radium. In the other case, unfortunately, only a few tissues were available for postmortem examination (femur, lung). The measurements were carried out, in collaboration with Dr. A. Janitzky and Dr. A. Krebs, in the following manner: The emanation content of the exhaled air was determined according to the alpha-ray method developed in our institute by A. Janitzky for the determination of small quantities of emanation. The determination of activity postmortem in the various organs was carried out on the incinerated tissues. The temperature for incineration was not greater than 500°. The measurements consisted in: (1) By means of a point counter (developed according to suggestions of A. Krebs) the rates of emission of individual alpha particles from the specimens were registered. (A diagram of the counter is shown in Figure 1. It was standardized

by means of an especially made radium preparation of determined activity.) (2) Further, both to verify the results obtained with the counter, and to make separate determinations of the radium and the mesothorium deposits, the incinerated tissue was completely dissolved in various acids (H_2SO_4, HCl, HNO_3) and the absolute radio-active content determined by the emanation method. For the final evaluation of the results, the data according to the emanation method were used to give the absolute quantities of material present, while the counter data were used to determine the distribution of the activity in the various tissues. The results of the measurements are shown in Tables III and IV, for cases F-2, 1935, and B-1, 1935, respectively. In both cases, both radium and mesothorium were found. In the more thoroughly investigated one, F-2, 1935, the ratio of radium to mesothorium was approximately 2.5:1. In Table V are given the radium deposits found in the Case F-2, 1935. This represents the lower limit of the total amount of radium in the body; actually the total here must have been about 6 micrograms radium equivalent.

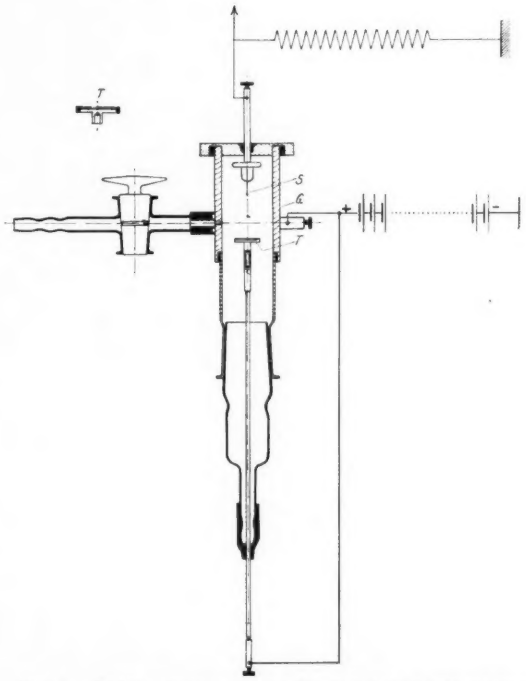


Fig. 1. Point counter for the determination of the radium content of the tissues. S = platinum points; T = specimen carrier; G = housing. Arrow at top indicates lead to amplifier with loud speaker and counter.

In this case, the immediate cause of disease was apparently the deposit in the lungs, which was a small fraction of one microgram. Granting that this value may be low, it can still be stated that a quantity of radio-active material of the order of magnitude of one microgram of radium equivalent is certainly harmful, when deposited internally.

We have undertaken a series of investigations with the idea of determining this limiting injurious dose experimentally. Among the results obtained up to the present time may be mentioned some on the influence of radon on metabolism. Details of this work will be published else-

TABLE I.—NATURAL RADIO-ACTIVE CONTENT OF BODY TISSUES

Normal radium content of the human body:
approximately 1.5×10^{-8} grams = 0.015 microgram radium element;
or 10^{-12} grams radium per gram tissue (based on 15 kilograms weight of bones, liver, spleen, etc.).

Tolerance dose: 1.9×10^{7} ions per second per gram, corresponding
to 5.5×10^{-10} grams radium per gram tissue = 0.00055 microgram of radium per gram of tissue.
or Tolerance dose = 550 × normal content.

Average content of the earth's crust in radium:
approximately 2×10^{-12} grams radium per gram of rock = 2 micro-micrograms radium per gram rock.

Radium content of pure metals (Pb, Zn, Fe, Al):
approximately 10^{-14} grams radium per gram metal = 0.01 micro-microgram radium per gram metal.

Emanation content of the atmosphere, over the mainland and close to the ground; 10^{-16} curies per cubic centimeter = 2.75×10^{-4} Maché units;
or 1.77 emanation atoms per cubic centimeter of air.

where. Here it is sufficient to state that the lower limit of the dose which will effect a definite change in the metabolism is about 1.5×10^{-5} curie-hours per cubic centimeter. If this is compared to the dose obtained in Case F-2, 1935, above, which terminated in fatal poisoning, it is found that the two lie very close together. In consideration of the relatively rough estimation which has (of necessity) been made here, too much emphasis should not be placed on this good agreement; it does, however, appear permissible to conclude that in both cases the dose is of the same order of magnitude. Hence it seems that the above considerations regarding the limiting dose for definite damage are verified experimentally. This dose exceeds the normal radium content of the tissues by only about 60 to 90 times, and is hence considerably less than the "tolerance dose" in roentgen or radium therapy. It is important to note the difference in the distribution of the activity in the tissues in the two cases we have been discussing.

From the practical standpoint, perhaps the most important conclusion to be drawn from our measurements is the extraordinarily small amount of poisoning substance deposited, which may result in serious damage. It can be stated with certainty that the accumulation of one microgram of

TABLE II.—NORMAL RADIUM CONTENT OF SOME BODY TISSUES

(*According to measurements by A. Krebs, 1936–1937*)

Tissue	Content of 1 gm. of fresh tissue
Lung	$(0.2 - 10) \times 10^{-12}$ gm. radium equivalent
Spleen	0.4×10^{-12}
Liver	1.2×10^{-12}
Bones	1.0×10^{-12}

TABLE III.—DISTRIBUTION OF RADIUM DEPOSITS IN RADIUM-POISONING CASE F-2, 1935

Tissue	Absolute Value in Micro-micrograms Radium Equivalent	Relative Value Compared to	
		Spinal Cord	Lung
Spinal cord	340	100	390
Rib	330	97	380
Femur	210	61	240
Lung	87	26	100
Liver	29	8.5	33
Spleen	7.4	2.2	8.5
Heart	0.74	0.2	0.8

TABLE IV.—DISTRIBUTION OF RADIUM DEPOSITS IN RADIUM-POISONING CASE B-1, 1935

Tissue	Absolute Value in Micro-micrograms Radium Equivalent	Relative Value Compared to		Remarks
		Femur	Lung	
Femur	3.5	100	6	Measured with Point Counter
Bone marrow (yellow)	2.3	66	4	
Lung	60	1,700	100	

TABLE V.—TOTAL AMOUNTS OF RADIO-ACTIVE MATERIAL DEPOSITED IN THE ORGANISM IN CASE F-2, 1935

(*Lower limits*)

Tissue	Weight (gm.)	Total Content in 10^{-8} Gram Radium Equivalent
Lung	710	6.2
Liver	1,070	3.4
Spleen	100	0.074
Heart	250	0.019
Spinal cord	about 28	0.95
Skeleton	estimated	250.0
Remainder of body	estimated	20.0

Total amount (lower limit) approximately three micrograms radium equivalent.

radium equivalent may result in deadly injury to the organism. Since, however, the total amount introduced into the body is not retained, but a certain fraction eliminated, the question arises as to the permissible quantity which can be taken in without causing irreparable injury. This leads to the necessity of investigating the elimination of radio-active materials from the body. In Table VI are shown the

TABLE VI.—ELIMINATION OF RADIUM BY THE HUMAN BODY

(*Average values*)

No.	Method of Introducing Radium	Time Interval	Percentage Radium Remaining	Individual Variations
1	Intravenous injection	2 weeks	3–4.5	
2	Intravenous injection	5 weeks	3–4.5	
3	Intravenous injection	6 months	4.3	2–11
4	Intravenous injection	1 year	1.9	0.2–5
5	Intravenous injection	1⅔ years	2.4	
6	Intravenous injection	1⅔ years	1–1.5	0.9–4
	After the first six months After about two years		About 4 About 2	
7	*Per Os*	3 years	About 0.5	
8	*Per Os*	3 years	About 0.7	

quantities of such materials retained in the body after certain periods of time. These data show that after a lapse of a certain time following the introduction of radio-active material into the body, a stable distribution of the substance is reached, which will be altered only slightly by further elimination. By a simple approximation it appears that in order to have a residual deposit of one microgram of radium equivalent, it is necessary to have introduced at least 100 micrograms orally, or 20 micrograms intravenously or by inhalation. These quantities must not be considered as the upper limit, for, as we have seen, when radium is introduced into the body it is deposited in many places, and not uniformly, so that for damage to a certain organ the required radium concentration is not necessarily reached by this borderline dose.

A further important question appertaining to the effectiveness of radio-active substance in the body is that of the emanat-

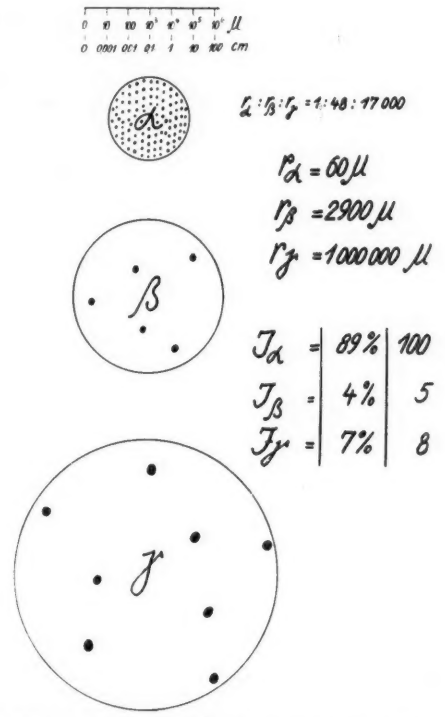


Fig. 2. Range and ionizing power of alpha, beta, and gamma rays.

ing power of material thus deposited. Here only a few general statements have been made, which really refer not to the emanating power of the actual radio-active material, but to that of the body as a whole (exhaled air). In general, this is relatively small, amounting to from 2 to 10 per cent of the total emanation of the fixed substance. Only in a single case was a greater amount (up to 40 per cent) observed. We have been able to investigate this important matter directly in relation to the emanation of the individual tissues. The results obtained are presented in Table VII. Since the emanation of the whole body in this case was about 10 to 20 per cent, it is evident that a considerable part of the emanation remained in the body, leading to the building up of the amount of

long period radio-active substances. In addition, it can be concluded from the data that small deposits of radio-active

TABLE VII.—EMANATING POWER OF VARIOUS TISSUES

(*in vitro*)

Tissue	Radium	Mesothorium
Femur	100	15 (73)
Rib	66	16
Lung	9	17
Bone ash	37	33

substance in human and animal bodies, of the order of magnitude of one microgram radium equivalent, or even a fraction of this, are sufficient, in the case of a predisposition in the organism, to cause an existing damage or weakness to proceed to an irreparable injury. This finding, which is in agreement with American authors (Flinn) is, at first, possibly surprising, when it is considered that the body can resist very much greater amounts of radiation from external sources in radium and roentgen therapy. I may mention again the roentgen tolerance dose, which is appreciably higher than the above-mentioned limiting dose for internally deposited radium. This difference is, however, understandable if one looks more closely into the mechanism of action of the material deposited in the tissues. It is evident that the biological effect of the deposited material is mainly due to alpha particles, in contrast to the gamma radiation used in ordinary radiation therapy. The relative ranges and intensities of ionization by the three types of radium radiations are shown diagrammatically in Figure 2. It is sufficient to compare the ionization resulting from the alpha and gamma rays, to find an explanation of the increased effectiveness of the internally deposited material. While the injuries produced in tissue by a gamma ray are extremely few per unit volume, those due to alpha particles are highly concentrated. Correspondingly, a cell traversed by a gamma ray can more readily recover than one destroyed by an alpha projectile. It may then be assumed that the alpha-particle effect in the tissues is completely cumulative, while the gamma-ray effect is known to be in a large measure dependent on the recovery factor (protraction of dose).

THE VALUE OF RADIATION IN THE TREATMENT OF CARCINOMA OF THE BREAST[1]

By LEWIS G. ALLEN, M.D., *Kansas City, Kansas*

THE question of the value of radiation in the treatment of carcinoma of the breast has, within the past twenty years, undergone a metamorphosis from an original suggestion to the most recent conclusion of Hutchison (8), who, after a critical analysis of published statistics, concludes that surgery is no longer unchallenged as the treatment of choice in mammary cancer. In an effort to qualify the position of radiation in the problem, many analyses by many authors have been made.

Choice of Type of Radiation.—The choice between x-ray and radium as the type of radiant energy to be employed is in comparative agreement by radiologists. It is possible that the success attending the use of the large and expensive radium bomb may change our present conception. At the present time, however, it is generally agreed that interstitial radium finds its more rational employment in those areas wherein an intense local effect is desired. Keynes (9), Adair (1), Pack (15), Lee (11) and others have perfected a technic in which the insertion of radon and element needles throughout the lesion and adjacent lymphatics is comparatively successful. However, homogeneous radiation of a large irregular surface by the interstitial route is difficult. Lee (12) states that tumors larger than six centimeters in diameter are incapable of proper treatment by interstitial radiation and that the treatment of the axilla must be confined to the lower two-thirds because of the caustic effect of intense radiation on the brachial nerves and vessels. All workers are agreed that in cases in which interstitial radiation is to be employed a combination with external radiation is also required. Few radiologists possess enough radium to permit the employment of sufficiently large packs, trays, or bomb applications, as recommended by these authors. Pfahler (17) concludes that the combination of the technic of Keynes (9), supplemented by external roentgen radiation, may prove to be the method of choice in the treatment of the primary breast cancer.

TABLE I.—HUTCHISON'S COMPARATIVE AVERAGES (5 YEARS)

	Early	Late	Unclassified
Surgery Alone	71.3 per cent	35 per cent	28.1 per cent
Radium Alone	47.1 per cent	16 per cent	

The five-year curability by interstitial radiation alone, of all groups of mammary cancer, as taken from the published statistics, appears to be less than the success obtained by operation alone (Table I). Coutard is the author of the statement that at the Curie Institute in Paris and the Radiumhemmet of Stockholm, interstitial radiation in the treatment of carcinoma of the breast has been abandoned except in the local treatment of a residual tumor mass following x-ray therapy or in other isolated or selected instances.

The use of x-ray is becoming more universal with each year's experience and particularly with each improvement of the technic of application. Technics have changed rapidly and the analysis of the value of the changing technics is slowly accumulating. Radiologists are generally agreed that we have in the 200 kv. apparatus ample intensity for the generation of x-rays necessary in the treatment of mammary cancer located in the breast or in the regional lymph nodes. We have to concern ourselves chiefly with the quantity of x-ray and the interval of administration. The principle of the saturation technic as advanced by Pfahler has unquestionably

[1] Read at the Midsummer Radiological Conference, Denver, Colo., July 15–17, 1937.

added to success in the treatment of the disease. Finally, the theory of periodic sensitivity as advanced by Coutard (a development of his plan of protracted radiation) appears most rational. Analyzing the technics as they have been employed, we are convinced that our errors have been on the side of insufficient quantity, perhaps as the result of over-caution.

Danger of Pleuro-pulmonary Roentgen Fibrosis.—The deleterious effect of radiation on the lungs and pleuræ following radiation of extrathoracic tumors has received considerable attention, beginning with the report of Groover, Christie, and Merritt. It is my opinion that this danger has been overemphasized and, like the fear of radiation skin reactions, may contribute, in a measure at least, to under-treatment. In the recent report of Hsieh and Kimm (7), which covered 12 patients who showed definite radiographic evidence of post-radiation changes, one is impressed with the non-serious character of the complications. Portmann (20) has proved the advisability of the use of x-rays generated at a lower tension as well as tangential projection over the chest wall in the post-operative prophylactic application of x-ray. That his contribution is of value and should be appreciated in the planning of the cycle, the author is convinced. At the same time, the principal problem is the quantity of radiation to be delivered to the tumor and to the site of possible lymphatic extension.

That the proper application of roentgen radiation alone is successful in eradicating the malignant disease in certain cases has been abundantly proved. Bloodgood, Geschickter, Wood, Cheatle and others have shown that irradiated breast carcinomas of mice are sterile both to tissue culture and transplantation. We have all seen occasional cases and Adair (1) reports a series of cases in which the pathologist was unable to find malignant cells in breasts and nodes that had previously contained cancer as proven by biopsy, following intensive pre-operative radiation.

Value of Surgery Acknowledged.—I am quite sure that radiologists are not yet ready to advise delimitation to radiation alone in the treatment of cancer of the breast, especially in that group of cases in which the surgeon feels he can successfully remove the malignant disease in its entirety. The problem is too difficult and the stakes too high to permit any spirit of competition to qualify our action or advice to the patient.

Surgery, since the introduction of the Halstead operation, has proved its great value and, for the present at least, it would appear from statistics of large groups of cases that radiation and surgery in combination offer most to the operable, comparatively or definitely, radioresistant lesion. A suggested tendency away from post-operative treatment is seen by some authors, due to a closer selection of cases for surgery, limiting the choice to those cases in which the disease is confined strictly to the breast. Fischel says that he has referred no patient for post-operative therapy for several years, for the reason that he operates on only those cases in which he can remove all malignant tissue. If such a selection of operable cases is followed, it is apparent that a larger percentage of cases will fall into the inoperable class to be handled by radiation.

Surgery Limited by Extent of Disease.—That the malignant lesion is limited to the breast alone is extremely difficult to assume. Portmann (20) says that competent pathologists find axillary nodes involved in 90 per cent of specimens examined and he doubts that the disease may be removed completely when it has advanced to an involvement of the regional nodes. The fact that five-year cures from surgery alone have improved only slightly in the last 20 years may contribute to prove Portmann's statement.

White (25) analyzed 195 cases and found that, clinically, 38 per cent had palpable nodes. After removal, careful microscopic examination proved axillary metastasis to be present in 51 per cent of these cases. Therefore, the disease is frequently present

when nodes are not palpable. Pfahler and Vastine (18) estimated that when disease is present in the axilla, the percentage of cures by operation alone varies from 15 to 24 per cent; so that, if we take 23 per cent as a liberal average of five-year cures by operation alone, it is shown by the literature and by Pfahler's reports that about double this figure, or 46 per cent, is obtained when post-operative irradiation is given. Therefore, Pfahler shows that post-operative irradiation is equal in value to operation.

Grace and Moitrier (4) report a series of 40 cases in which only simple mastectomy was performed even though axillary extension was obvious. All of these patients were treated by x-ray in recurring series for the remainder of their lives, and five-year survivals showed a 10 per cent improvement over a similar number of patients treated by radical operation. These writers were convinced from the analysis of their series that a relatively larger number of deaths from metastases occurred when more radical surgery was employed than followed incomplete removal and intensive x-ray therapy.

Meissel (13), who worked up Eiselberg's figures in Vienna, showed that when the growth was enucleated and the axillary growths removed only when they were palpably enlarged, recurrences were encountered in 62.8 per cent and metastases in 17.1 per cent of the cases. In the group of cases in which the breast, enlarged nodes, and pectoral fascia were removed, recurrences were encountered in 50 per cent and metastases in 20.28 per cent. Lastly, in that series wherein complete radical amputation was practised, recurrences were met in 25 per cent and metastases in 36.6 per cent. Therefore, these writers argue that the more radical operation entails a greater liability to distant metastases; that simple mastectomy with adequate radiation produces end-results which are as satisfactory as those of any other procedure in general practice, and that no loss of function of the arm, distressing lymph stasis, and fewer metastases will result.

Definition of Operability.—As found in the literature, the grouping of cases as to operability is by one of three plans. Cheatle says that "whether a tumor be operable or not depends upon the accessibility or inaccessibility, respectively, of all its parts to the means adopted for its extermination. The degree of accessibility of its parts to surgical methods is not the same as its degree of accessibility to radiation." He qualifies mammary cancer operable from a clinical point of view "when there are no invaded lymphatic glands in the axilla or even when one lymphatic gland, and certainly not more than two lymphatic glands, are invaded and situated in close proximity to the breast." A second plan, that of Steinthal, consists in considering three groups. Cases falling in Group 1 are considered operable. He defines Group 1 cases as those which have small, slowly growing, movable tumors without skin involvement and a minimum or no axillary extension. The third plan is that of Burton J. Lee (12), who includes a much larger group in the so-called operable class. He considers a case as "operable when the patient has a tumor of the breast that is not fixed to the chest wall, with or without invasion of the axillary nodes."

More recently, Portmann (22) has suggested still another classification, based on both clinical and pathologic evidences. He defines as Group 1 those cases in which the tumor is free, definitely localized in the breast, the skin not involved, and no metastases to the axillary nodes. Portmann believes that Group 1 should be operated upon and not irradiated and that the more advanced cases should have post-operative irradiation.

Diagnosis.—Bloodgood (2) has shown that the percentage of carcinomas in patients presenting themselves for examination is growing smaller each year. This fact is no doubt explained in large part by a greater consciousness among women of the importance of early diagnosis of the lump in the breast—an advance in the cancer problem to which Bloodgood has contributed largely.

Because women do come early, the clinical diagnosis of cancer is becoming increasingly more difficult. Roentgenography of the breast is contributing to the solution of the problem. Biopsy, however, in general practice particularly, is too frequently performed. Many of these tumors and nodules in the breast are benign. All professors in surgery have stressed the great danger of surgical exploration of such a breast. Immediate radical removal of the breast and axillary contents in such a case would remove many early carcinomas and dangerous early stages of the disease, but at the same time it is apparent that the policy would result in too frequent unnecessary mutilation.

Biopsy.—I feel that the removal of tissue from the breast for examination is a problem to be considered with great deliberation and should surely follow less objectionable detail study, as popularized by Lockwood and Hicken. That it may be solved in the average case when properly evaluated, I do not doubt. At the same time, I believe that the practice of the local removal of lumps and nodules, as frequently seen in general practice, without appreciation of the necessity for gentleness, avoidance of squeezing, and extension of the disease beyond the area of incision, is too frequently pursued.

Keynes (9), who did biopsies in the first 50 of a series of cases treated by interstitial radium, became convinced that the plan was dangerous and discontinued the practice. Pfahler (19) says he is fearful of the traumatism incident to biopsy, and Cheatle recommends that it be done very infrequently. He says: "It is probably necessary once in a thousand." If positively required, he advises that great caution be exercised and a pack saturated with a solution of 1–500 of bichloride of mercury be left in the site of the excision of a whole quadrant, or better, one-half of the breast.

The pathologic classification of mammary cancer is most exact, tumor types surely forming the basis of type prognosis. Harrington (5) has shown that microscopic grading is a reliable prognostic case guide. The same cannot be said, however, for the frequently reported opinion of radiosensitivity or radioresistance based on pathologic appearance alone. Too many factors in addition to the microscopic appearance define the ultimate reaction to radiation to permit such a distant conclusion to be entirely reliable. The clinical grouping and evaluation of the patient and her disease are much more reliable criteria. The terms "radiosensitive" and "radioresistant" are relative in their radiologic definition and are not entirely synonymous with "embryonal" and "differential." Nicolson and Berman (14), by comparing the pathologic and the clinical grading in their series of 70 cases, showed the clinical grading to be much more reliable from the standpoint of prognosis, the contrast being most marked in the pathologic Grade 3. They quote Trout's résumé as having shown conclusively the superiority of clinical over pathologic evaluation.

If we attempt, by a review of the literature, to obtain a composite figure of curability of mammary cancer by various efforts, we are confused, as shown above, by the variation in classification as to the stage of the disease, as well as by multiple methods and combinations of methods employed by the various authors. Also, it must be remembered that "five-year survivals" and "five-year cures" may be as different as "living" and "living free from disease" or "living without recurrence."

TABLE II.—CURABILITY SHOWN BY STATISTICS—5-YEAR SURVIVALS

Untreated cases live, on average, 34 months	12.0 per cent
Pettit's average of 9,000 (operation only, unclassified)	28.8 per cent
Pfahler's compilation of more than 10,567 cases (operation only)	30.1 per cent
Average	29.4 per cent

The average as reached by eight authors estimates the natural duration of life of untreated carcinoma of the breast at 34 months. Lazarus-Barlow and Leeming (10) report 651 untreated cases with three-year survivals of 25 per cent and a five-

year survival of 12 per cent. Pettit's (16) average of over 9,000 cases reported by 32 surgeons showed a five-year survival of 28.8 per cent following operation. Therefore, it would appear that 12 per cent of carcinoma of the breast patients will survive a five-year period if untreated; that of the fraction of the group not advanced to a point to be considered inoperable, if treated by surgery alone, 28.8 per cent will survive the five-year period. Pfahler's (19) more recent compilation of 10,567 cases places the five-year survival figure at 30.1 per cent, or an average, let us say, of 29.4 per cent.

Pfahler (19) compared reports from seven clinics before and after the addition of post-operative radiation. This comparison showed an improvement after the addition of radiation to the plan of treatment of from 11.4 to 73.7 per cent in all cases; and when applied to Stage 2 alone, from 15 to 110 per cent. The mean average five-year survival of all cases treated by operation alone was 33 per cent and when irradiated post-operatively was 47.4 per cent. His comparison of a large group of special clinics' reports with each other gave approximately the same figures.

TABLE III.—PORTMANN'S 85 NON-IRRADIATED CASES AND 85 IRRADIATED CASES: ALL GROUPS EQUAL

	5-year Survival Percentage	
	I	II
Non-irradiated	100.0 per cent	52.4 per cent
Irradiated	94.5 per cent	76.2 per cent
	III	Average
Non-irradiated	2.7 per cent	38.3 per cent
Irradiated	8.1 per cent	47.4 per cent

Portmann (21) has shown that 38.3 per cent of 85 traced and classified patients with carcinoma of the breast survived a five-year period when treated by operation alone; that when x-ray was given post-operatively to 85 traced and similarly classified patients, in whom the disease was present to the same degree, the survival was increased to 47.4 per cent. (In his Group 1, post-operatively graded, no benefit was obtained by post-operative irradiation. In his Group 2, 52.4 per cent lived five years without x-ray and 76.2 per cent lived five years when treated post-operatively.)

The value of pre-operative irradiation is not so impressively shown by published statistics, although it might be argued that what is good for the breast post-operatively might be even better if applied pre-operatively. Of Pfahler's (17) series of 1,022 cases, only 9 per cent received both pre-operative and post-operative radiation therapy. These cases were mostly far advanced and of a type which was made operable by pre-operative irradiation. Of this group, 60 per cent lived three years and 55 per cent lived five years. Pfahler's (19) average of four authors gave 51.3 per cent.

TABLE IV.—RECAPITULATION: CURABILITY SHOWN BY STATISTICS, 5-YEAR SURVIVALS

Untreated live average of 34 months	12 per cent
Compilation average, operation only (unclassified)	29.4 per cent
Compilation average, post-operative irradiation (unclassified)	47.4 per cent
Compilation average, pre-operative and post-operative irradiation (unclassified, mostly advanced)	51.3 per cent

To recapitulate, then, we may conclude that the average five-year survival in all classifications of cancer of the breast, when untreated, is 12 per cent; that of the group accepted and treated by surgery alone, the five-year survival becomes 29.4 per cent; that when treated by surgery and post-operative irradiation the five-year survival equals 47.4 per cent, and that when treated pre-operatively and post-operatively, the five-year survival becomes 51.2 per cent.

Forty-six per cent of Pfahler's (17) patients who were referred for treatment because of local recurrence lived five years, and 31 per cent lived ten years. Bucholz (3) reports that one-third of the cases treated by operation only have recurrences within the first year. In Portmann's (23) series, 24 per cent had recurrence in the first year following operation alone, while

only 18 per cent recurred in the first year when the operation was followed by prophylactic radiation. The average time elapsing between the first sign of recurrence and the institution of radiation treatment in Pfahler's group of 433 recurrent cases was 6.8 months.

Burton J. Lee (12), after reviewing the recent literature up to 1932, covering the reports of 3,079 breast cancers, showed that the operators employing post-operative irradiation furnished in general the higher percentage of cures. Lee employed in his series of 217 cases both pre-operative and post-operative irradiation and says, in conclusion, "It seems reasonable to assume that the added factor of irradiation has been responsible for better end-results."

Irradiation has something to offer to the inoperable breast cancer case and its contribution should not be handicapped by ill-advised radical removal. Proper irradiation may make an inoperable case rationally operable. Gottsman says, "When radical operation for breast cancer is carried out in the presence of contra-indications, it shortens the life of the patient." Deaver and McFarland conclude that indications for the palliative operation are seldom met, for, they explain, operations of this type contribute nothing to the comfort of the patient or to the prolongation of life; on the contrary, the end is frequently hastened by exciting the disease to a more extensive growth.

It is our opinion that the radical operation without previous irradiation, in all except true Type 1 cases, not only cannot succeed in anything like a fair percentage, but that it also complicates the problem of administering either x-ray or radium post-operatively. Merritt has recently pointed out that radical surgery for cancer of the uterus, the prostate, or bladder, as well as block dissections of the neck, have largely been abandoned, and asks pertinently, "Why not the inoperable breast also?"

I am quite willing to ascribe to the premise that a good operation is better than poor radiation therapy and I feel that the reverse is equally true. Good radiation cannot compensate for hasty or ill-advised mastectomies. The size and age of the patient, stage of disease, tumor type and grade, and extent of involvement deny a standard technic, and detail attention to radiation technic is parallel in importance to good surgical technic.

Finally, the application of Coutard's theory of periodicity of sensitivity of mammary cancer seems most reasonable to the writer.

Nothing can be found in the literature to show that pre-operative treatment is injurious even to that group of primary tumors in which surgery alone gives excellent five-year results, and it has been conclusively shown that evaluation of the extent of the disease is difficult.

CONCLUSIONS

May we conclude, then, that conservative Stage 1 cases of slowly growing breast cancers occurring in patients 40 years of age are statistically a primary surgical problem.

Pfahler (19) writes that less than 10 per cent of all breast cancers come in early Stage 1, and Harrington (5) reports that only 20 per cent of operable cases are still in Stage 1 when operated upon. Particularly because of the unreliability of the clinical identification of the true Stage 1, a large number of authors consider operable breast cancer, particularly in young women, a primary radiation problem at least demanding an effort at radiation sterilization before operation. Prompt regression of the tumor size by comparatively small total roentgen dosage before the appearance of the radio-epidermite in any of its manifestations defines the tumor as radiosensitive, suggests an anaplastic type lesion, which early invades the lymphatics, and indicates a continuance of radiation as the primary method of treatment. It is estimated that about 15 or 20 per cent of all breast cancers will fall in this group. The fibrotic, essentially sterile tumor residue may be removed by mastec-

tomy or by interstitial radiation when operation is refused or contra-indicated.

In a similar case of operable breast cancer, if the tumor regression does not occur promptly, even after raising the daily radiation intensity from 200 to 400 or 600 r measured on the skin, by two fields for a minimal total of 3,500 r in ten days, we should assume that the tumor is relatively radioresistant and is of a type which more frequently metastasizes late and demands operation as the primary method of treatment. Coutard considers the optimum time for surgical removal to be between the fifteenth and twentieth day after the beginning of the roentgen treatment. It is estimated that about 20 per cent of all breast cancers fall in this group. More intense pre-operative radiation of these highly radioresistant tumors is not believed to be of great value. Post-operative radiation is rational in an attempt to sterilize those cells which remain and which are rendered more radiosensitive by the temporary cellular activity following the operation.

Between these two extremes, there remains the larger group of lesions (about 60 per cent) of medium radiosensitivity. Of this group the great majority will be shown by the initial radiation to be relatively radioresistant; when operable, they become a surgical problem to be followed by post-operative radiation, as in the case of the definitely radioresistant lesions.

In the treatment of the inoperable breast cancer, treatment of the radiosensitive type lesion is probably best protracted, using the smaller daily doses over a long period of time, while the proven radioresistant tumor, after determining its level of sensitivity, is irradiated in recurring series. Coutard's theory of periodic sensitivity, calling for institution of irradiation beginning on the thirteenth, twenty-sixth, thirty-ninth, and perhaps the fifty-second day, seems rational. Such a plan in the treatment of mammary cancer includes no radical departure from the proven route we have followed to our present degree of success. Rather, it offers a definite program of rational combined surgical and radiation efforts.

The ovarian influence in the development of cancer of the breast has received intensive study and the fact appears well established that cancer of the breast is more malignant in the young woman. Lee (12) says, "Of patients 40 years or under, 27 per cent are alive and well at the end of five years, whereas of those over 40 years of age, 45 per cent were alive and well at the end of five years." There appears to be an almost unanimous opinion that pregnancy is a serious complicating influence in the patient who has cancer of the breast. Trout (24) collected 15 cases in which pregnancy occurred after operation and of these, 87 per cent developed carcinoma in the remaining breast. Pfahler (19) quotes a number of authors as having produced marked benefit by both surgical and irradiation sterilization in recurrent or metastatic cancer of the breast lesions. He cites Harrington's (6) statistics as proof that 75 per cent of operable cases have remnants of the disease after the operation, which suggests routine employment of ovarian sterilization to avoid estrogenic influence on the cancer remnants. Isolated reports are being made of marked improvement of extensive metastatic involvement following roentgen sterilization. It is the opinion of a number of observers, based both on clinical observation and experimental evidence, that the internal secretory function of the ovary responsible for the apparent stimulation of breast cancer continues for some time after the menopause, and although not universally accepted, it has been suggested that ovarian irradiation should be carried out in the instance of those patients who have just passed the menopause.

Therefore, it would appear that ovarian sterilization as a pre-operative and post-operative prophylactic measure is fully justified on the basis of preventing future pregnancies and particularly in avoiding the deleterious stimulative influence of internal ovarian secretion associated with the menstrual function.

REFERENCES

(1) ADAIR, FRANK E.: The Effect of Pre-operative Irradiation in the Primary Operable Cancer of the Breast. Am. Jour. Roentgenol. and Rad. Ther., **35,** 359–370, March, 1936.

(2) BLOODGOOD, J. C.: Permanent Results of Irradiation for Inoperable Cancer, and Remarks on Irradiation as Pre-operative Treatment in Operable Cancer of the Breast. Am. Jour. Surg., **28,** 490–497, May, 1935.

(3) BUCHOLZ: Quoted by Pfahler (17).

(4) GRACE, E. J., and MOITRIER, W., JR.: Simple Mastectomy with X-ray in Treatment of Carcinoma of Breast. New York St. Jour. Med., **36,** 701–704, May, 1936.

(5) HARRINGTON, S. W.: Carcinoma of the Breast; Surgical Treatment and Results Five, Ten, and Fifteen Years after Radical Amputation. Surg., Gynec. and Obst., **56,** 438–441, February, 1933.

(6) Idem: Quoted by Pfahler (19).

(7) HSIEH, C. K., and KIMM, H. T.: Changes in the Lungs and Pleura following Irradiation of Extrathoracic Tumors. Am. Jour. Roentgenol. and Rad. Ther., **37,** 802–810, June, 1937.

(8) HUTCHISON, R. G.: Value of Radiation Therapy in Treatment of Carcinoma of the Breast: Critical Analysis of Published Statistics. Surg., Gynec. and Obst., **62,** 653–664, April, 1936.

(9) KEYNES, G.: The Radium Treatment of Carcinoma of the Breast (Interstitial Radiation). British Jour. Surg., **19,** 415, January, 1932.

(10) LAZARUS-BARLOW and LEEMING: Quoted by Pfahler (17).

(11) LEE, BURTON J.: Quoted by Pfahler and Vastine (18).

(12) Idem: End-results in Treatment of Cancer of the Breast by Radical Surgery Combined with Pre-operative and Post-operative Irradiation. Am. Jour. Surg., **20,** 405–443, May, 1933.

(13) MEISSEL: Wien. klin. Wchnschr., **17,** 1904.

(14) NICOLSON, W. P., JR., and BERMAN, M. D.: Carcinoma of the Breast: Study of Five-year End-results. Ann. Surg., **103,** 683–695, May, 1936.

(15) PACK: Quoted by Pfahler (18).

(16) PETTIT, R. T.: The Value of Surgery and X-ray Treatment in Cancer of the Breast. Am. Jour. Surg., **30,** 510–514, December, 1935.

(17) PFAHLER, G. E.: Results of Radiation Therapy in 1,022 Private Cases of Carcinoma of Breast from 1902 to 1928, including 127 Cases in which Radium and Roentgen Rays were Combined. Am. Jour. Roentgenol. and Rad. Ther., **27,** 497–508, April, 1932.

(18) PFAHLER, G. E., and VASTINE, J. H.: Technic and Results of Irradiation in Carcinoma of the Breast: Review of 1,129 Private Cases. Am. Jour. Roentgenol. and Rad. Ther., **33,** 41–49, January, 1935.

(19) PFAHLER, G. E.: Treatment of Carcinoma of the Breast: Caldwell Lecture. Am. Jour. Roentgenol. and Rad. Ther., **39,** 1–18, January, 1938.

(20) PORTMANN, U. V.: Roentgen Irradiation in the Treatment of Mammary Cancer. Am. Jour. Roentgenol. and Rad. Ther., **31,** 46–50, January, 1934.

(21) Idem: Comparison of the Results in a Series of Cases of Carcinoma of the Breast Treated by Post-operative Roentgen Therapy and Prophylaxis with Similar Series in which Operation was the Only Treatment. Am. Jour. Cancer, **27,** 1–25, May, 1936.

(22) Idem: Classification of Mammary Carcinomas to Indicate Preferable Therapeutic Procedures. RADIOLOGY, **29,** 391–402, October, 1937.

(23) Idem: Quoted by Pfahler (17).

(24) TROUT, H. H.: Carcinoma of the Breast. Surg., Gynec. and Obst., **65,** 370–375, September, 1937.

(25) WHITE, W. C.: Cancer of the Breast, page 1024. Harper & Bros., New York, 1930.

FURTHER STUDY ON THE DIRECT AND INDIRECT ACTIONS OF RADIATION ON MALIGNANT CELLS

I.—TRANSPLANTATION OF TISSUE CULTURES OF MOUSE SARCOMA 180 AFTER EXPOSURE TO ROENTGEN RAYS: II.—CULTURES OF TUMORS IRRADIATED *in vivo*

By KANEMATSU SUGIURA, D.M.Sc., *and* IRVING COHEN, *New York City*

From the Chemical and Biophysical Laboratories, Memorial Hospital, New York City

FROM recent studies it appears that tumor regression following irradiation is due not alone to the direct action of the radiation on the malignant cells, but also to an additional influence contributed by the tissues of the host. This is made evident by the following facts: (*a*) Tumors of Mouse Sarcoma 180 *in vivo* require 1,500 roentgens to produce complete regression in 85 per cent of the cases (1); (*b*) fragments of this tumor irradiated *in vitro* require around 3,000 roentgens to prevent "takes" when re-implanted into normal mice (2); (*c*) tumors treated *in vivo* with a dose of 1,500 roentgens and left *in situ* for varying lengths of time before transplantation to another host, produce "takes" when left in the original host one, two, or three days, but generally there are no "takes" when the irradiated tumors are left in the original hosts for six days or longer (3).

Experimental studies of Prime (4), Kimura (5), Roffo (6), Spear (7), and Goldfeder (8) have indicated that malignant cells cultivated *in vitro* are not affected by x-rays or gamma rays from radium unless given an enormous dose of radiation. It was also shown that fragments of tumors irradiated outside the body and then planted in tissue culture require equally large doses of radiation to stop outgrowth of tumor cells. Un-published work by Henshaw and Cohen of this institute shows that fragments of Mouse Sarcoma 180 irradiated outside the body and maintained *in vitro* (tissue culture) require considerably more than 3,000 roentgens to prevent migration and growth in the culture medium.

The work here reported was planned to determine to what extent tissue cultures of Mouse Sarcoma 180 which had been irradiated *in vitro* with a dose of from 100 to 10,000 roentgens will produce tumors when the tissue cultures are implanted into mice.

Experimental.—As the first step in the present investigation we carried out several preliminary experiments to determine the degree of transplantability of the cultures of non-irradiated tumor tissues of Mouse Sarcoma 180 in albino mice. For the cultivation of the malignant cells of the tumor, Maximow's "flying cover slips" method was used.

Pieces of tumor tissue, each weighing about 0.6 mg., were placed in a medium containing three parts of human blood serum, one part of chick embryo extract, and one part of fowl plasma. The slides containing the tumor fragments were then placed in the incubator at 37° C.

Examinations of the 48- and 72-hour cultures showed good outgrowth of sarcoma cells in most cases (Fig. 1-*A*), sparse outgrowth in a few cases, and very infrequently no growth (Fig. 1-*B*). Actively growing cultures showed numerous spindle and round cells, but the ratio between these cells among different cultures was irregular. There were also numbers of macrophages and very rarely blood granulocytes.

At the end of two or three days of incubation, the explants, together with small amounts of gelatinous material surrounding them, were removed with small forceps and inoculated into normal mice, the implants being made subcutaneously in

the region of the axilla by the usual trocar method.

This preliminary study included six groups of experiments, involving a total of 49 cultures. The results obtained from these experiments showed that 13 per cent (two out of 15 actively growing cultures) of the cultures failed to grow if singly implanted in each animal. However, if two cultures, whether of good or fair growth, were placed in a trocar and injected into each animal, none failed to grow (17 implantations). These tumors were morphologically identical with the original sarcoma. The culture transplants grew progressively at nearly the same rate of growth as implants from 6 mg. fresh tumor tissues. However, there were instances in which the development of a palpable tumor required a period of two weeks.

Nine-day-old tissue cultures which had been bathed in Tyrode solution once every third day, and fresh plasma medium added, produced tumors when inoculated into animals.

Another point to be noted in this connection is that implants of tissue cultures which showed no outgrowth of sarcoma cells in the culture (Fig. 1-*B*) completely failed to produce tumors, irrespective of double or triple culture implantation (16 negative growth cultures).

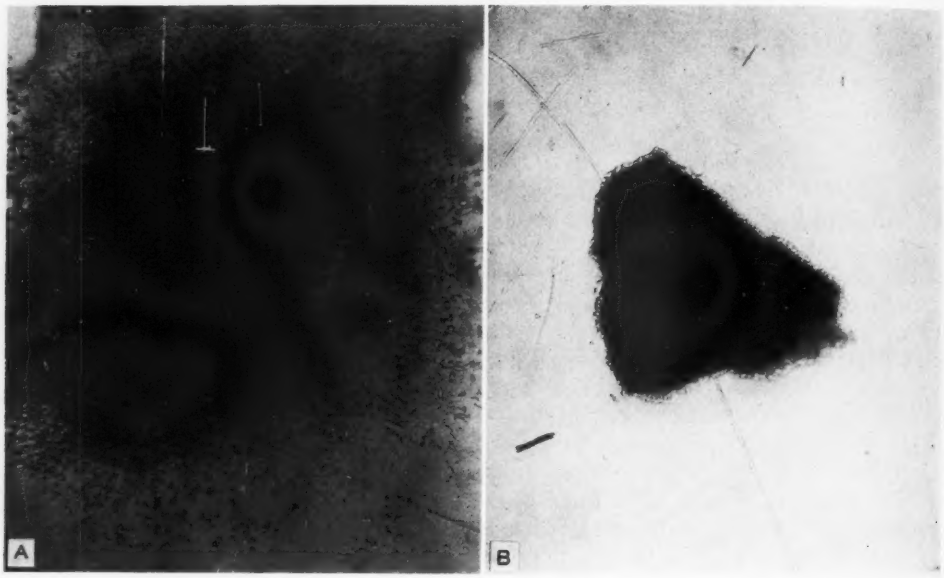


Fig. 1. Forty-eight-hour tissue cultures of non-irradiated Mouse Sarcoma 180. *A* shows good outgrowth of sarcoma cells (× 85): *B* shows no outgrowth of sarcoma cells (× 85).

Transplantation of Tissue Cultures of Mouse Sarcoma 180 Irradiated in vitro.—On the basis of findings with cultures of non-irradiated tumor tissues, it may be considered that the technic is adequate for the purpose of our experiments.

The fragments of a fresh Mouse Sarcoma 180, each weighing about 0.6 mg., were placed in a celluloid moist chamber and were irradiated under the following conditions: 200 kv., 30 ma., 0.10 mm. copper and 1.15 mm. celluloid filters, and 34 cm. distance. Under these conditions the tumor tissues received 291 r per minute.

At the end of definite intervals of time, the irradiated tumor fragments were removed from the celluloid moist chamber

and then cultured in the usual manner. They were allowed to grow in the incubator at 37° C. for from two to four days during which the fragments attained good growth.

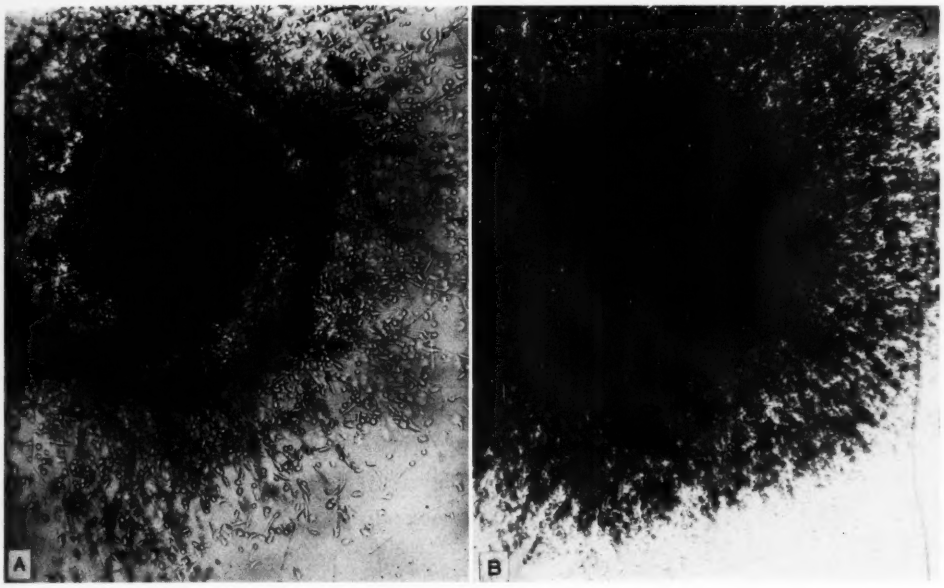


Fig. 2. Forty-eight-hour tissue cultures of Mouse Sarcoma 180 irradiated *in vitro* with doses of (*A*) 500 r, and (*B*) 1,500 r. Note the good outgrowth of sarcoma cells (× 85).

It was found that cultures from tissues irradiated with a dose of from 100 to 10,000 r showed no great difference in the outgrowths of sarcoma cells (spindle and round cells) compared with those of non-irradiated tumor tissue (Fig. 1-*A*). Typical examples of these are illustrated with photomicrographs of living cultures (Figs. 2 and 3).

The cultures from the irradiated and non-irradiated tumor tissues were inoculated into normal mice in the usual way, using the double culture implantation technic. Aseptic precautions were taken throughout.

The data obtained from the experiments are given in Table I.

The study included the inoculations of animals with cultures showing no growth. These cultures consisted of 16 from non-irradiated tumor tissues, four from tumor tissues irradiated with a dose of 500 r, four from 1,500 r, four from 3,000 r, six from 5,000 r, and four from 10,000 r. Inoculation of these cultures into normal animals gave rise to no tumor growth. These results, however, are omitted from Table I.

The foregoing experiments show clear-cut results. The growing cultures of sarcoma tissues originating from fragments which had been irradiated outside the body with a dose of 2,000 r or more, regularly failed to produce tumors on inoculation into mice. Inoculation of growing cultures of this tumor irradiated with a dose of 1,500 r produced tumors in 25 per cent of the cases. On the other hand, the growing cultures of sarcoma tissues which had been irradiated with a dose of 1,000 r or less produced tumors in every case upon inoculation into the animals. The growth rate of these tumors in animals was essentially the same as that from non-irradiated cultures. The tumors

were in no way different from tumors produced by non-irradiated sarcoma cells.

Microscopic examination of growing cultures of sarcoma tissues treated with a dose of 1,000 r or 3,000 r reveals no variation in the amount of proliferating tumor cells. However, upon inoculation of these cultures into animals, the former produced typical sarcoma, while the latter completely failed to produce any tumor. Such differences in their development may be accounted for by the presence in the normal tissues of tumor-growth-inhibiting substances. It is reasonable to believe that tumor cells under exposure to a large dose of radiation may have been attenuated and thus rendered unable to proliferate in animal tissues. In this connection, it is of importance to mention the findings of Prime (4) on the effects of beta and gamma rays of radium on tissue growth *in vitro*. He found that only those cultures which, after irradiation still showed mitosis, produced tumors upon inoculation into animals. However, cultures which showed outwandering of cells after irradiation, but no mitosis, failed to produce tumors. Roffo (6), working with a transplantable rat sarcoma, found that malignant cells cultivated *in vitro* were not affected by doses in excess of the amount ordinarily used in the treatment of human cancer. He also found that the tissue cultures from the irradiated rat sarcomas produced typical tumors when inoculated into rats.

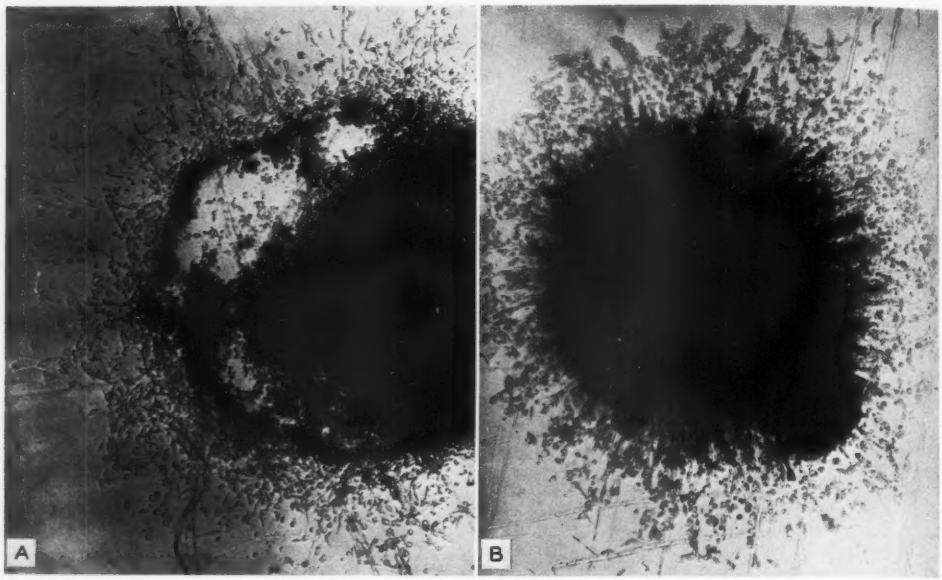


Fig. 3. Forty-eight-hour tissue cultures of Mouse Sarcoma 180 irradiated *in vitro* with doses of (*A*) 5,000 r, and (*B*) 10,000 r. Note the good outgrowth of sarcoma cells (× 85).

Cultures of Tumors Irradiated in vivo.— It was shown in a previous paper (3) that if tumor implants (Mouse Sarcoma 180), grown for about seven days in animals, are treated with 1,500 r while in the host, and immediately removed and implanted in other non-irradiated mice, about 80 per cent will grow progressively as is the case of tumor fragments irradiated *in vitro* with the same dose of roentgen rays; if they are allowed to remain in the original hosts for 24 hours before re-implantation, only 50 per cent will survive; if left three days before re-implantation, only 20 per

cent "takes" will result, while complete inhibition of growth generally will occur in those left in the original animals for six days or longer. These variations in the viability of tumor fragments at different intervals after irradiation can be correlated with changes in their histologic appearance. Thus, tumors remaining three days in the hosts after irradiation show markedly swollen tumor cells covering almost the entire area of the section. The cytoplasm appears granular, and some areas are finely vacuolated. At the periphery, many active tumor cells and mitotic figures are seen. Polymorphonuclear leukocytes and lymphocytes are present in much greater number than in non-irradiated tumor tissues.

TABLE I.—RESULTS OF TRANSPLANTING GROWING TISSUE CULTURES OF MOUSE SARCOMA 180 AFTER EXPOSURE TO FILTERED ROENTGEN RAYS *in vitro*

No. of Experiments	Dose in Roentgens	No. Tissue Cultures Used	No. Animals Used	Growth of Culture Transplants in Animals (per cent)
14	0	82	41	100
1	100	6	3	100
2	500	8	4	100
2	750	12	6	100
2	1,000	12	6	100
7	1,500	32	16	25
5	2,000	28	14	0
4	3,000	18	9	0
1	4,000	4	2	0
5	5,000	22	11	0
6	10,000	20	10	0

Chambers and Grand (9), working with the same tumor, namely, Mouse Sarcoma 180, found that the longer the tumors had remained *in situ* after *in vivo* irradiation with doses around 2,800 r, the sparser was the outgrowth of sarcoma cells in tissue culture. Cultures from irradiated tumors remaining for six days in the hosts showed no outgrowth of true sarcoma cells. The same authors pointed out that "the amount of sarcomatous growth was in inverse proportion to the abundance of blood granulocytes present and that the abundance of polymorphonuclear leukocytes from these fragments was found to vary directly with the length of time between irradiation and tumor removal."

TABLE II.—RESULTS OF CULTURING MOUSE SARCOMA 180 AFTER EXPOSURE TO FILTERED ROENTGEN RAYS (1,500 r) *in vivo* AND REMAINING *in situ* FOR VARYING PERIODS

No. of Tumors	Interval between Irradiation and Tumor Removal	No. Tissue Cultures Made	Sarcomatous Growth of Cultures (per cent)
1	30 min.	6	100
2	3 hrs.	6	83
3	3 hrs.	5	80
4	1 day	6	100
5	1 day	6	100
6	2 days	6	83
7	2 days	6	67
8	2 days	6	67
9	2 days	6	17
10	3 days	6	33
11	3 days	6	33
12	3 days	6	33
13	3 days	6	17
14	3 days	6	0
15	4 days	6	100
16	4 days	6	83
17	4 days	6	0
18	4 days	6	0
19	5 days	6	0
20	5 days	6	0
21	5 days	6	0
22	6 days	6	0
23	6 days	6	0
24	7 days	6	0
25	7 days	6	0
26	8 days	6	0
27	8 days	6	0
28	8 days	6	0

In order to secure further information concerning the decreasing viability of irradiated tumor tissue the longer it remains in the host, we made the following tissue culture experiments.

When tumor grafts had grown for about seven days in animals and had attained diameters of from 5 to 12 mm., they were irradiated with a dose of 1,500 r in the same manner as that previously described. At the end of definite intervals of time the tumors were removed from the animals and non-necrotic fragments were planted in tissue culture in the usual way. The results are presented in Table II.

As may be seen from the data in Table II, the results are not clear-cut. As previously stated (1) a dosage of 1,500 r *in vivo* does not give 100 per cent regression.

Natural resistance in the individual animals, difference in the size of tumors, and non-uniform conditions of the irradiated areas may well have some influence upon the tissue reactivity. However, certain conclusions may be drawn. If tumors are irradiated *in vivo* with a dose of 1,500 r and then removed within 24 hours and are cultured, generally 100 per cent will grow progressively. These cultures show good outgrowth of sarcoma cells as is the case of those in which the tumor fragments were directly implanted in other animals. If the irradiated tumors are allowed to remain in the original hosts for three days before culturing, only about 33 per cent will show slight migration and growth of sarcoma cells, and about 30 per cent of the growing cultures will produce tumors on inoculation into animals. On the other hand, complete inhibition of sarcoma growth generally will occur in those left in the original animals for five days or longer.

In general, many of these treated-tissue cultures showed blood granulocytes in much greater number than is normally present in cultures of non-irradiated tumor tissues. In some cultures there was no outgrowth of sarcoma cells but an abundance of granulocytes. The presence of these cells is probably due to their accumulation in the dying tumor following irradiation.

SUMMARY

1. The transplantability of tissue cultures of Mouse Sarcoma 180 which had been irradiated outside the body with a dose of from 100 to 10,000 roentgens of 200 kv. filtered x-rays was studied.

2. The growing cultures of sarcoma tissues irradiated with a dose of 1,000 r or less produced typical tumors in every case upon inoculation into mice.

3. The growing cultures of tumor tissues irradiated with a dose of 2,000 r or over completely failed to produce tumors upon inoculation into animals.

4. Tumors irradiated *in vivo* with a dose of 1,500 r and left *in situ* for varying length of time before removal and culturing, gave outgrowth of tumor cells when the interval in the original host was one, two, three, or four days, but there was no outgrowth of tumor cells when the irradiated tumors were left in the original hosts for five days or longer.

5. Tissue cultures of tumors irradiated *in vivo* showed a greater number of polymorphonuclear leukocytes than in non-irradiated tumors.

The authors wish to express their thanks to Miss Gladys Cameron, of the Laboratory of Cellular Physiology at New York University, and to Dr. P. S. Henshaw, of the Biophysical Laboratory of the Memorial Hospital, for their co-operation and valuable suggestions during the course of the work.

REFERENCES

(1) SUGIURA, K.: The Effect of Roentgen Rays on the Growth of Mouse Sarcoma 180 Irradiated *in vivo*. RADIOLOGY, **28,** 162–171, February, 1937.

(2) Idem: Reaction of Transplantable Mouse Sarcoma 180 to Radiations of Different Wave Lengths (200 kv. of Roentgen Rays and Gamma Rays). Am. Jour. Roentgenol. and Rad. Ther., **31,** 614–627, May, 1934.

(3) Idem: Studies on Radiosensitivity of Mouse Sarcoma 180 Irradiated *in vivo* and *in vitro*. RADIOLOGY, **29,** 352–361, September, 1937.

(4) PRIME, F.: Observations upon the Effects of Radium on Tissue Growth *in vitro*. Jour. Cancer Research, **2,** 107–130, 1917.

(5) KIMURA, N.: The Effects of X-ray Irradiation on Living Carcinoma and Sarcoma Cells in Tissue Cultures *in vitro*. Jour. Cancer Research, **4,** 95–135, 1919.

(6) ROFFO, A. H.: La acción de las irradiaciones Roentgen sobre el desarrollo y biologia de las culturas in vitro del tejido neoplásico. Bol. Inst. de Med. Exper. para el estud. y trat. del cáncer, **3,** 771–786, 1926.

(7) SPEAR, F. G.: Tissue Culture. II, III.—Its Application to Radiological Research. Brit. Jour. Radiol., **8,** 68–86, February, 1935; **8,** 280–297, May, 1935.

(8) GOLDFEDER, A.: Studies on the Effect of Radiation upon Growth and Respiration of Various Tissues *in vitro*. RADIOLOGY, **31,** 73–80, July, 1938.

(9) CHAMBERS, R., and GRAND, C. G.: Leukocytic Infiltration of Irradiated Mouse Sarcoma 180. Proc. Soc. Exper. Biol. and Med., **36,** 673–675, June, 1937.

THE ROENTGEN DIAGNOSTIC IMPORTANCE OF ADIPOSE TISSUE

By DR. JOSEF SILBERMANN, *Vienna*

From the Roentgen Institute of the Hospital of the Israelitische Kultusgemeinde, Vienna; Professor J. Borak, Chief

TRANSLATION BY E. T. LEDDY, M.D., THE MAYO CLINIC, ROCHESTER, MINN.

THE normal human tissues can be divided, according to G. Perthes, into four groups, corresponding to roentgen physical laws. They differ from each other by their various specific weights and, therefore, by their difference of absorption of penetrating roentgen rays. This classification is as follows:

1. Bones, calcifications: specific weight 1.9 (strongest absorption).
2. Soft parts, connective tissue, cartilage, etc. (the same density as water): specific weight 1.0.
3. Fat tissue: specific weight 0.9.
4. Tissues which contain air, or gasses resembling it, such as the lung: specific weight 0.0013 (weakest absorption).

Fat tissue is of importance in analysis of the roentgenogram insofar as by its slight absorption of roentgen rays it can be separated in topographical relationship from the tissues which have higher specific weight. It is, therefore, possible with improvements in exposure technic to assign much more attention and importance to the relationship of the fat deposits and the other soft tissue shadows around them.

In the following we shall discuss only the physiologic and pathologic relationships of fat insofar as they are of importance in the present status of our knowledge of roentgen diagnosis, particularly in the larger organ complexes and regions of the body, and shall consider them comprehensively.

Extremities.—Around all extremities the adipose tissue, together with the connective tissue of the panniculus adiposus of the skin extends into the depths, spreads out there over the surface of the muscle bundles, then surrounds with varying thickness all the separate muscles. It then spreads through the various anatomical cavities of the body between the organs, bridges over as a rule the flexor side of the greater joints, and then reaches the distant portions of the extremities. Embedded in it the large vascular and nerve tracts are protected by fat.

By this distribution of the fat layers we are able in the roentgenogram to separate the various muscle layers from each other, and to bring into topical relationship with the various muscles any process lying in them.

The fact that fat tissue is developed more in the lower extremities than in the upper is of roentgenologic importance.

One will often see in lateral views of the upper thigh a very transparent area of fat taking the form of a right-angle triangle around the femoral condyle and extending about as far as the middle of the posterior surface of the upper femur. The anterior margin of this triangle is formed by the shadow of the musculature arising from, and running along, the upper femur and closely adjacent to it (the mass of adductors and vastus lateralis muscles, the short head of the biceps femoris, and so forth). The posterior margin of the shadow is formed by the extensors of the thigh and also by the flexors of the leg, while the base of the triangle is formed by the gastrocnemius muscle. The location corresponds to the fat in the popliteal fossa and around the planum popliteum.

This collection of fat makes possible the fact that anatomical structures lying in it can often be recognized plainly on films because they can be brought out by their definite density of tissue and their specific weight, heavier than that of the surrounding structures. This is particularly true of dilated varicose veins. It is possible, therefore, to verify the clinical diagnosis of deep-

lying varicosities by a suitable roentgenogram.

Around the ankle joint one often sees in lateral views a noticeable layer of fat. One can see between the posterior surface of the tibia covered by the mass of the extensors of the toes, the Achilles tendon, and the surface of the calcaneous, a roughly triangular field, the height of which may be about 20 cm. and the base from 2 to 4 cm.

This site is of importance not only on account of the varicose veins which it may contain, but, also, because in a suitable film one can see swellings of the talocrural joint which on account of its deep location oftentimes cannot be successfully palpated. In these cases the talocrural joint capsule arches over toward the surrounding fat and hence can be definitely distinguished by its arch-shaped shadow (Fig. 1).

Also, anterior to the ankle joint one can often see inside the tendons a circular or oval shadow, of deeper intensity than the tendons, which is formed by vessels surrounded by fat, which lie parallel to the vertical beam of x-ray. Anatomically, this is caused by a tibialis anterior artery or vein seen lengthwise or by a perforating branch of the peroneal artery seen on end. Since this shadow can be mistaken for a foreign body or for a broken-off piece of bone it seems important to describe more in detail its cause, position, and the possibility of differentiating it by the fat which surrounds it.

Let it be mentioned here that the origin of the Achilles tendon shadow in lateral views is demonstrable by its contrast from the fat triangle lying on the anterior surface and the subcutaneous fat bodies which lie on its posterior surface.

Fig. 1. Fig. 2. Fig. 3.

Fig. 1. Swelling of the upper portion of the ankle.
Fig. 2. Lipoma with bony trabeculæ, anterior posterior view.
Fig. 3. Lateral view.

The curled-up soft part shadows which can be seen in views of the planta pedis are caused by differences of absorption of the widely developed fat and the connective tissue strands. But not all the more or less regularly occurring roentgen transparent spots are due to collections of fat. For example, mucus bursæ (the mucus which fills the bursæ has a specific weight similar to that of fat; myomas produce similar shadows, however, they are quite rare tumors) produce a similar roentgen effect. They can be seen particularly well in the area between the lesser trochanter and the superior ramus of the pubis as more or less sharply delineated, roundish places formed by the bursæ between the gluteal musculature and the biceps femoris.

These should be differentiated from the irregularly arranged transparent areas which are caused by pathologic deposits of fat or by lipomas. As their recognition is important from a surgical standpoint, we shall discuss them in greater detail.

Around the extremities lipomas may produce sharply demarcated, roundish shadows or branching, indefinitely defined shadows. One may also see pure lipomas and those with a mixture of connective

tissue, cartilage, bone, and blood vessels. All these forms, however, originate from the fat tissues, as Billroth stated, which surround the muscles.

Lipomas will produce such characteristic roentgenograms, depending upon their position, their size, and suitable roentgen technic, to the extent that the statement made by Chasin that the roentgenologic diagnosis of lipoma seems to be more accurate than the clinical diagnosis, in most cases seems to be correct. Clinically, only the more superficial lipomas can be diagnosed and then only when they can be accurately palpated and defined: if the tumor has the characteristics of a lipoma—slow growth, long duration, occurrence only at more advanced ages, soft consistence, lobulated structure, good movability, temperature differences from those of surrounding structures, and the like.

On the contrary, however, very often lipomas have a cutaneous location. These are of short duration, grow to a considerable size, and may even lead to a diagnosis of malignant tumor. Also, occurrence of multiple lipomas is noticed, particularly after pregnancy.

A clinical examination is almost entirely valueless when the lipomas are located under the fascia or deeper, or are situated intramuscularly, at which time the difficulty of differential diagnosis from fibroma, angioma, sarcoma, metastasis, parasitic cysts, neurinoma, etc., increases. In such cases roentgenologic examination may be of considerable help. For example, Spitzenberger reported at the Vienna Röntgengesellschaft, the case of a child one and one-half years old who, after a fall, developed, in four months, a swelling around his right hip the size of half an apple. Clinically, the diagnosis of sarcoma was made. Roentgenographic examination demonstrated a lipoma. What confusion may be caused by an atypical position of a lipoma can be seen by a demonstration by Giordina. In one patient a round swelling in the groin was palpated, clinically regarded as an undescended testis. In this case the lesion was a lipoma.

In suitable cases roentgenologic examination may demonstrate lipomas located intramuscularly, as it did in one of the writer's own cases. One can see, in Figures 2 and 3, around the forearm a round shadow about the size of a plum which is separate from the surrounding soft part shadows as a transparent area of marked contrast. This difference in absorption of roentgen rays caused by differences in the specific weight of fat and its surrounding soft parts is one of the most important characteristics of lipomas.

The lipoma just described had another peculiarity worthy of note: it was really a mixed tumor, a fibrolipoma. In one place the connective tissue had been transformed into osteoplastic tissue, forming true bone. The periosteum of the bones of the forearm was intact everywhere.

True bone formation is relatively rare in lipomas. Generally, it is the result of deposit of calcium after trauma or central fibrosis of a lipoma. On the contrary pure intramuscular lipomas often occur.

Interesting are the studies of Chasin, who attempted to find out the size of a lipoma, around the extremities, which could be demonstrated roentgenologically. He studied cadavers in which he deposited various-sized pieces of fat at various depths. For the upper extremities of ordinary thickness, according to his findings, a lipoma must be at least 2 cm. in diameter to be demonstrable. In the upper thigh it must be about 10 cm., and in the leg about 6 cm.

In order to demonstrate lipomas definitely, technical tricks are oftentimes necessary. The lipomas must be brought as near to the surface as possible and exposed tangentially to the roentgen rays. The quality of the radiation should be soft. Highly superficial pedunculated lipomas, particularly those around the fingers and occasionally on the back of the hand, should be examined, according to Laurell's suggestion, with the involved member in water. Due to the differences in absorption between water and fat, very satisfactory roentgenograms can be produced in

this way. But since lipomas sometimes occur as poorly differentiated structures it is often roentgenographically impossible to differentiate lipomas and liposarcomas due to the fact that the lesion may not be sharply marginated.

Lipomas may also develop in the musculature of the tongue (Paget and Virchow).

For the sake of completeness it should be mentioned that lipomas may also occasionally originate in portions of the body which normally contain no fat; for example, in the central nervous system. In spite of careful search in the comprehensive neurologic textbooks I could not determine definitely whether such a heterotopic deposit of fat has ever been demonstrated roentgenologically, but as there is at least a theoretical possibility that it could be, I am discussing it here. First of all it should be mentioned that pure lipomas of the central nervous system are rare; ordinarily mixed tumors occur. These often have a lobulated structure and often show an infiltrating growth and behave as true liposarcomas. They are found in the cerebrum, usually around the corpus callosum, sometimes in the tuber cinereum, and in the meninges. In the spinal cord lipomas are even rarer. They usually develop around it or within the so-called sacral tumors, especially in combination with spina bifida occulta and aperta.

The total number of the central lipomas described to date is perhaps not a hundred.

At this point should be mentioned lipomas originating in the bronchial mucosa which were first described by Rokitansky. They are, however, as Lenk has stated, recognizable bronchographically only as bodies which block the lumen and produce bronchial stenosis, but their fatty nature cannot be demonstrated in a roentgenogram because of their small size and their unfavorable location.

Fig. 4.

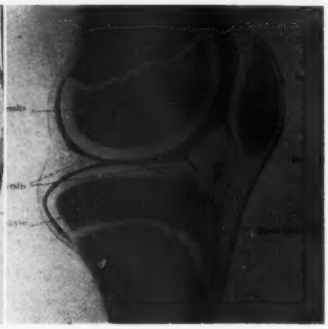


Fig. 5.

Fig. 4. Vichart's fat plug, frontal section through the skull of a child.
Fig. 5. Plica alaris.

The same holds true of heterotopic lipomas in the kidney capsule developed from capsular fat cells which have separated off embryologically.

At this point we should mention Vichart's fat plug which is important in the mechanism of swallowing (Fig. 4.). Whether or not this can be demonstrated roentgenologically is at present uncertain, but perhaps with a correct roentgen technic it might produce a subtraction effect.

Joints.—As we have already stated, the fat tissue usually surrounds the flexor side of the joints. Around the larger joints there is usually formed a mass of fat between the joint membranes. This is particularly true in the knee joint. Here there can be found between the synovial membrane and the fibrous capsule of the knee joint, both precondylar and infrapatellar, a collection of fat which extends the syno-

Fig. 6. Fig. 7. Fig. 8.

Fig. 6. The roentgen effect produced by plica alaris.
Fig. 7. A fat triangle made smaller by infiltration and pressure of a chondrosarcoma.
Fig. 8. The normal side.

via onto the bony condyles. The anatomists call this the "plica alaris." Figure 5 shows this triangular fat body in a knee joint preparation cut longitudinally.

Because of this deposit of fat below the patella, in a lateral section the precondylar space appears in the form of a roentgenographic translucent triangle (Fig. 6).

If this joint fat extends as far as the cartilaginous surface of the joint, then we can sometimes, particularly in joints of the young, recognize the joint cartilage as a delicate marginal seam.

By means of this fat formation we can recognize other processes in the soft parts which extend either by infiltration or penetration of the fat in the knee joint, particularly by the lateral view. It is very impressive to make a comparison with the healthy side.

Figures 7 and 8 illustrate what has just been said. This was a case of chondrosarcoma, verified by biopsy (a diagnosis of chondrosarcoma could be made roentgenologically at a time when the first biopsy showed only chondroma), in the upper third of the tibia which had penetrated into the joint space and which could be separated definitely from the rest of the compressed and infiltrated fat triangle. A photograph of the amputated specimen with the knee joint opened by an infrapatellar horizontal section shows the relationships of the various tissues which have different specific weights (Fig. 9).

Also, inflammatory processes in the joint capsule can be demonstrated by a lateral view of the knee, thanks to the deposition of fat bodies around the joint.

Chronic inflammatory diseases which penetrate into the fat masses and produce an increased thickness by infiltration also should be discussed: one sees them in the diseased joint, irregular unsharp outlines of the diminished fat shadow.

We should mention in addition some other diseased processes of the knee joint fat because they may well lead to diagnostic errors from the roentgenogram. Inside the fat bodies there can take place proliferation of connective tissue (sclerosis of fat tissues) either alone or mixed with deposits of calcium or of bone. This fat tissue sclerosis as a primary process is to be differentiated from the secondary process, such as chronic productive capsular lesions,

displacement of the meniscus, and so forth. Hoffa has encountered this primary fat sclerosis in his operations on the knee joint both with and without calcification, and has described it in detail. He insists on

mediastinal pleural lamella where this, near the apex of the heart, blends with the diaphragmatic pleura. This "three-leafed angle" formed by the serous tissues is generally filled up with loose connective tissue.

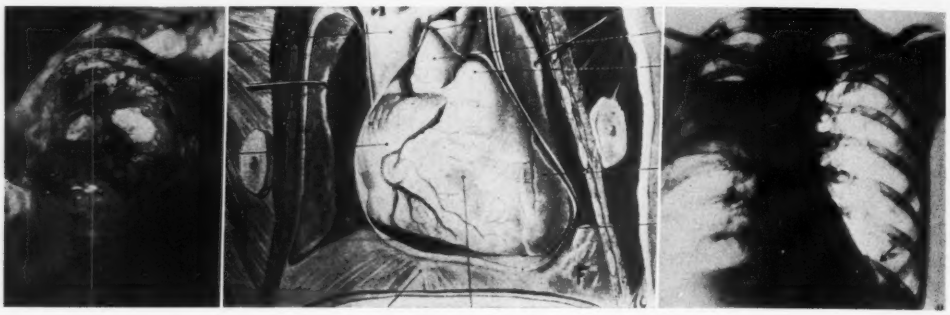


Fig. 9. Fig. 10. Fig. 11.

Fig. 9. View of the condyles of the femur. The lobulated fat structures can be seen; therefore, tumor tissue.
Fig. 10. Schwarz'scher "Fettbürzel."
Fig. 11. The triangular shadow at the apex of the heart caused by "Fettbürzel."

the importance of differentiating calcifications of this kind from displaced bone and free bodies. Roentgenograms of such knee joints are remarkable in that they show a lack of the light effect which the knee joint fat shows elsewhere. In place of the translucent triangle we then find a more or less homogeneous shadow of about the same density as the soft parts in which lime deposits can be seen.

Here let it be mentioned that it is not to be determined definitely from the surgical and roentgenologic literature whether or not lipoma aborescens of the knee joint produces a distinct roentgenogram.

Further, let us call attention to collections of fat around the intervertebral disks in degenerative diseases of the nucleus pulposus. As S. Glasscheib demonstrated at the Vienna Röntgengesellschaft, in lateral views of the spine, slit-shaped, translucent zones are found around the intervertebral disks.

Fat Tissue in the Thoracic Cavity.—The thorax of many adults shows near the apex of the heart a physiologic collection of fat. It is located between the external leaf of the pericardium and the parietal leaf of the

One can sometimes recognize this space on good films as a triangle meshed with delicate lines. Römheld has wrongly regarded this shadow formation as the pericardial tip. In many cases there is formed a pyramid-shaped fat body in this connective tissue space. Figure 10 shows it in a frontal section through the thorax. It was G. Schwarz who recognized this fat body roentgenologically. After him it has been named the "*Schwarz'scher Fettbürzel.*" It formed a three-cornered shadow lying near the apex of the heart (Fig. 11).

Sylvia McGinn and P. D. White, in a monograph, pointed out the errors which can be caused by this fat bursa lying on the left side, both in orthodiagraphy and also in teleroentgenography of the heart. This fat bursa may cause a broadening of the left chamber and rounding off of the heart apex. Therefore, the two American authors recommend emphatically that the examination of the apex of the heart should be carried out with a narrow diaphragm and the exposure be made with correspondingly hard rays.

Much rarer is a deposit of fat around the right cardio-diaphragmatic angle. Its dif-

ferentiation from similar shadows such as those supradiaphragmatic veins and the hepatic veins, and those of the costomediastinal veins in the anterior mediastinum, may be very difficult. A costomediastinal shadow can be differentiated usually by the increased angulation of the diaphragm on inspiration. The differentiation of the vascular shadows can be done only by the sharp broadening of the heart toward the right, as hepatic veins cannot follow it on account of their diaphragmatic fixation. Such a case is described in Assmann's textbook.

Tuberculosis specialists make the statement that the Schwarz "Fettbürzel" in some forms of pulmonary tuberculosis may be very large. Also, in healthy individuals, even though there is a marked falling off of body weight, such a fat body may occur.

Breast.—Even though in different forms of obesity there occurs an abundant deposit of fat in the subcutaneous tissue, the lack of contrast between it and its surroundings puts roentgen diagnosis at a disadvantage. The fat in the well-developed breast has a definite roentgenologic importance. Lesions in the breast may cause changes in the fat which may be useful in demonstrating the lesions, as the shadows of the pathologic tissues stand out in sharp contrast from the fat and, therefore, differentiation is easy.

Within the normal breast the glandular mass forms a broad shadow above the fascia of the pectoralis major muscle which extends more or less conically toward the nipple. The irregular surface of the gland lobules which form the irregular margin of the shadow is leveled off by the subcutaneous fat. Around the shadow of the gland in the soft parts one can recognize thicker streaks originating from the larger connective tissue trabeculæ, and also, sometimes, roundish extensions of the breast caused by collections of fat (Fig. 12).

Fig. 12.

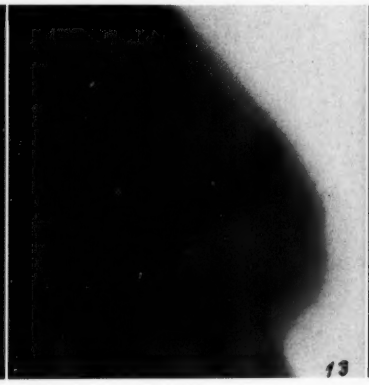


Fig. 13.

Fig. 14.

Fig. 12. Normal mammary structure.
Fig. 13. Scirrhus of the breast.
Fig. 14. View comparing the normal side.

By their contrast with the fat, pathologic conditions in the breast can often be definitely differentiated roentgenologically. It is, in fact, possible on the roentgenogram to form fair conclusions about the histologic nature of a process in the breast, especially true in cases of scirrhous tumors. Figs. 13–16 show such processes compared with those on the normal side.

It should be mentioned, though, that x-ray examinations of the breast should not have definite importance in determining whether or not this organ is the seat of a malignant process.

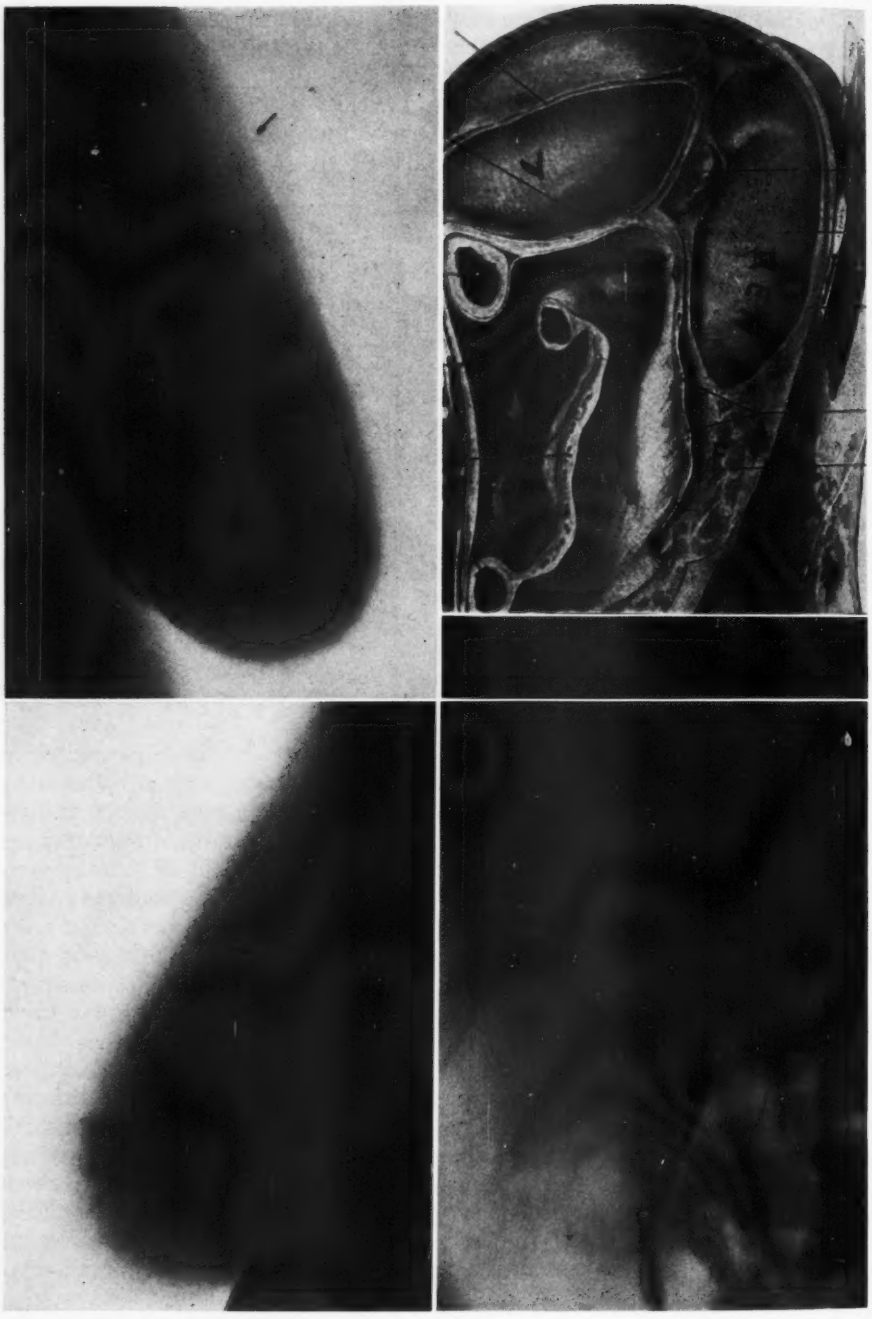


Fig. 15 (*upper left*). Arrow points to the lesion (blastoma).
Fig. 16 (*lower left*). Scirrhus.
Fig. 17 (*upper right*). Paramedian sagittal section: *V*, stomach; *P*, tail of the pancreas; *F*, perineal fat plug.
Fig. 18 (*lower right*). The kidney is distinguished by the fat capsule which has been exposed tangentially. Retrograde pyelogram.

In regard to the much discussed "roentgen-photographs" of the breast which have been done occasionally, and which appear mostly in the French literature, I might here sketch briefly a very simple technic used in our institute. The breast is projected free on the cassette by turning the patient, and then making the exposure straight-on. The demonstration of the mammary ducts by an injection of lipiodol which has been carried out extensively in America will in the future have growing importance.

The Kidneys.—Of very definite importance in the x-ray examination of the kidneys is the fat tissue lying in the retroperitoneal space. It is due to this that recognition of the size, shape, and position of the kidneys can be demonstrated. The retroperitoneal fat, as is well known, covers the secretory and excretory portion of the uropoietic system. It lies between the true fibrous renal capsule and two leaves of connective tissue, the fascia renalis, anterior and posterior, which originate from the tela urogenitalis and which surround the kidneys like a vise, caudally and cranially. This particular layer of fat in the retroperitoneal space, on account of its relationship to the kidneys, the anatomists name the capsula adiposa renis. This fat extends then, from the margins of the kidneys and the lower renal pole to the posterior abdominal wall and to the psoas muscle (Fig. 17).

The kidneys usually show up on the roentgenogram as definitely marginated shadows. As is well known, their density suppresses roentgen rays much more strongly than the surrounding tissues and, moreover, they have a definite contrast effect due to the fact that they have a higher specific weight than the fat lying around them.

Much more infrequent are roentgenograms in which the kidneys can be visualized as a more or less homogeneous field with a more or less broad outline demonstrable only by their margins. This finding is caused by the fact that the fat capsule was demonstrated by tangential radiation of the edges of the kidney (Fig. 18).

What importance fat may have in urologic roentgenography is best shown by study of the kidneys in nurslings and little children. Here the kidneys do not stand out distinctly because of poorly developed fat capsules. For that reason, deformities of the kidney which so often occur in nurslings oftentimes are not demonstrable roentgenologically. Thanks to the definite formation of perirenal fat, x-ray examination of the kidneys will permit not only demonstration of renal enlargement, atrophy, or displacement, but also, as Koll has described, will lead to a diagnosis of para- and peri-nephritic lesions.

As is known, they produce in the lumbar region within the renal fat, an intense shadow with roundish contour. This, together with elevation of the diaphragm caused by faulty respiratory displacement and sometimes a sympathetic pleural effusion, corresponds to the clinical findings, and has a high diagnostic value.

To what extent the lack of fat in cases of atrophy of various origin and dystrophies of a fatty nature may be of roentgenologic importance is uncertain at present, on account of the few observations which have been reported in this regard. The roentgen diagnosis of the various and previously completely ignored streaks and shadows is progressing. It is, therefore, to be expected that in the future more attention will be given to the fat tissue which, at present, is so largely ignored.

BIBLIOGRAPHY

1. ASCHOFF: Lehrbuch der pathologischen Anatomie (Allgem. Teil).

2. ASSMANN, H.: Die klinische Röntgendiagnostik d. inneren Erkrankungen. Leipzig, 1922.

3. BUFFALINI, M.: Beitrag zum Studium der intramusculären Lipome des Armes (Policl. sez. chir., page 373, Pisa, 1925). Fortschr. a. d. Geb. d. Röntgenstrahlen.

4. CALGER, GIULIO: Lipoma periosteo con metaplasia ossea centrale. Inst. di Clin. Chir., Univ. Milano. Zentralbl. für die gesammte Radiologie, 1935.

5. CHASIN, A.: Die Röntgendiagnose von Lipomen und ihre praktische Bedeutung. Röntgenpraxis, **2**, 282–287, March 15, 1930.

6. CORNING: Lehrbuch d. topogr. Anatomie.

7. GIORDINA: Lipom i.d. Inguinalfurche als retinierter Hoden. J. Jadassahns Handbuch der Haut und Geschlechtskrankheiten, **12**.

8. HENKE-LUBARSCH: Handbuch der spez. path. Anatomie (Knochen, Muskel, Sehnen).

9. KÖHLER, ALBAN: Teleröntgenographie des Herzens, D. m. W., **5,** 1908 (Assmann's Lehrbuch).

10. Idem: Grenzen des Normalen und Anfänge d. Path. im Röntgenbilde (Kap. Herz und Niere und Weichteile bei Extremit).

11. LAURELL, H.: Zur Röntgendiagnose klinish schwer feststellbarer fettfuhrender Tumoren, insbesondere Lipome. Upsala Lakaref. Fohr., **34,** 693–708, Nov. 30, 1928.

12. MCGINN, S., and WHITE, P. D.: Epipericardial Fat: Its Unrecognition Common Cause of Error in X-ray Measurement of Heart Size. Jour. Am. Med. Assn., **107,** 200, 201, July 18, 1936.

13. NILS, ANTONI: Tu des Rückenmarkes, seiner Wurzeln u. Häute (im Handbuch der Neurologie von Bumke u. Foerster).

14. SCHWARZ, G.: Ueber einen typ. Bef. am Herzen Fettleibiger. Wien. klin. Wchnschr., 1910 (Assmann's Lehrbuch).

15. SPITZENBERGER, O.: Demonstr. before Vienna Röntgengesellschaft, XII, No. 35.

16. TANDLER, JULIUS: Lehrbuch der system Anatomie.

RELATION BETWEEN RADIATION QUALITY FACTORS AND DEPTH[1]

By A. MUTSCHELLER, PH.D., *New York City*

From the Department of Radiology, New York Post-graduate Hospital and Medical School of Columbia University; William H. Meyer, M.D., Director

THE effects of radiant energy are quantitatively proportional to the radiation absorbed, and, therefore, whatever clinical result is to be produced in tissues will be proportional to the radiation absorbed in the tissues and at the location of the lesion to be treated. This is one of the axioms of modern physics and now a definitely accepted working principle of clinical radiation therapy known as Grotthus-Draper's law. As a further condition, because of the limitations imposed by skin erythema, the actual dose will be restricted to the accepted maximum skin tolerance dose and hence the tumor itself will receive but a fraction of this skin dose. Therefore, the efficiency of a given radiation for the therapeutic treatment of a deep-seated lesion is measured and expressed by the ratio of the dose tolerated by the skin to the dose absorbed by the tumor. It is customary to represent this ratio for various depth locations by curves which are generally known as *absorption curves*, and the various methods used today for defining the quality of radiations are expedients to define such absorption curves (1).

A curve of this kind, however, is an absorption curve in the true sense only when the actual intensity of the beam is measured by total absorption; if but a small fraction of the beam is measured, as we do with the commonly used ionization instruments and the radiation is monochromatic, then the curve is a fractional absorption curve (2). However, if the radiation beam is polychromatic and also measured with the small ionization chamber, then the measurements are not intensities but *doses stopped in air* and the true intensity of the radiation either at the surface or at the various depths is entirely unknown.

The reason for this is that in the latter case as the radiation penetrates into the absorbing substance it is further filtered, with the result that the intensity as well as the average wave length and the absorption coefficient become smaller. A curve of this kind, therefore, represents the intensity of the beam multiplied by a fraction which indicates what portion of the beam is absorbed in the ionization chamber or, in other words, the product of the intensity times the absorption coefficient in air. It now becomes quite evident that if the absorption coefficient is small, then even though a substantial radiation intensity may reach the selected depth, since there is but little absorption, there also can be but little biologic effect.

A curve of this kind does not represent the doses absorbed in a given volume or mass of tissues but, rather, it represents the intensity times the absorbability in air of the radiation at various depths. The latter factor is indicated by the slope of the curve, or the tangent or first differential coefficient, at the particular depth and this is equal to the absorption coefficient in air. Therefore, to distinguish such a curve from one which is a true absorption curve, we shall designate it as an *absorbability curve*.

The physical nature of the absorption process requires that, instead of the measured doses, the logarithm of the measured values be plotted. In the case of mixed radiations measured with small ionization chambers we generally obtain a curve which is bent outward from a tangent and, being so bent, this characterizes the curve as an *absorbability curve*. In such a curve,

[1] Presented before the Fifth International Congress of Radiology, in Chicago, Sept. 13–17, 1937.

the part corresponding to greater absorption thicknesses approaches a parallel direction with the thickness axis which implies that at that portion the absorption coefficient, and hence the absorbability, approaches zero value. Therefore if a lesion requiring treatment is located at a depth corresponding to this part of the curve, it would absorb but a minimum of the radiation reaching that depth, the greater portion being absorbed in the tissues lying above or beyond the lesion and, conversely, to obtain the proper absorption of radiation in the tumor the quality factors would have to be so adjusted as to bring the tumor within the range between the surface and the part of the curve that runs parallel with the thickness axis.

Clinically, this means that if the curve portion representing the location of the tumor is not sloped at all, the overlying tissues will receive all the injurious effects of the radiation dose and the tumor will be almost completely spared from the effects of the application.

From the foregoing it would be logical to conclude that for best results the tumor should be located where the greatest absorption takes place, as indicated by the strongest sloping of the curve; this, of course, would be near the surface where the curve ordinarily is most strongly sloped. However, clinical results indicate that a tumor of sufficient sensitivity can be successfully influenced even if it is located at a considerable depth and from this it follows that the patient can tolerate a considerable amount of radiation damage if, thereby, a sufficiently large and effectual dose is caused to be absorbed in the tumor. But clinical results also indicate that if the tumor is so located as to absorb an insufficient radiation dose, the result will be poor, evidently for the reason that the superposed and surrounding tissues will absorb the greater amount of the radiation dose and the tumor will stop practically nothing.

An *absorbability curve* can be represented with a quadratic or second degree equation with one unknown, and with the aid of the coefficients of this equation it is possible to calculate the thickness at which this minimum of absorption takes place. This is done by differentiating the equation and setting the derivative equal to zero. The result is the depth at which the curve runs parallel with the thickness axis, tending to turn upward, and at which the absorption is a minimum. The following results will be obtained from this operation:

$$x \text{ min. abs.} = \frac{\mu}{2\eta} \quad \ldots\ldots\ldots (1)$$

Taking this point of minimum absorption as a reference point, the question arises, "Where between this depth and the surface may a lesion be located to insure satisfactory clinical results from the treatment?" This question involves not only biologic and clinical considerations but also the tolerance of the patient for radiation damage, in order to produce thereby a sufficient amount of injury to the tumor for a good clinical result.

A survey of the records of cases treated during the last twenty years at the New York Post-graduate Hospital, under the direction of William H. Meyer, shows that the clinical results were consistently uniform and satisfactory in cases in which the sensitivity to radiation was reasonably well understood, provided the lesion (as, for instance, an ovary) was located not deeper than the 50 per cent dose depth (measured in water). When located at the 33 per cent depth, a repetition of the treatment was often required but at the 25 per cent dose depth, the results were quite uncertain (3).

The physical measurements of the radiation employed for the treatment of these cases give the following data: $\mu = .543$ and $\eta = .090$; the depth for the 50 per cent dose is 75 mm., for the 33 per cent dose, 105 mm., and for the 25 per cent dose it is 135 mm. in water.

If now, as herein presented, a point on a curve is given, easily determined by physical measurements, and another point indicating the depths at which various de-

grees of clinical results are obtained with the same radiation and filter, it appears probable that these points should be fixedly related and in a ratio of direct proportion. Therefore:

$$\frac{x \text{ abs. min. Cu}}{d/2(H_2O)} = \frac{\frac{\mu}{2\eta}}{x \text{ depth}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Through simplification and the substitution of known numerical values we obtain:

$$x \text{ depth } 50 \text{ per cent} = \frac{\mu}{2\eta} 27.4 = 13.7 \frac{\mu}{\eta} \text{ mm.} \quad (3)$$

In Table I the measurements obtained with various filters are given and side by side the measured and the calculated results for the depth at which a 50 per cent dose is measured. The last two columns show, within the accuracy of the measurements of doses in depths, that the postulated proportionality is a fact.

The converse of this conclusion is that if the tumor to be treated is located at a greater depth than that expressed in the above formula, then the radiation effect in the tumor becomes smaller and the injurious effects upon the superposed healthy tissues will be increased. Thus, less satisfactory results, as above referred to, will be obtained at the depth given by:

$$x \text{ depth } 33 \text{ per cent} = \frac{\mu}{2\eta} 41 = 20.5 \frac{\mu}{\eta} \text{ mm.} \quad (4)$$

Results which are generally unsatisfactory are obtained when the tumor is located at a depth represented by:

$$x \text{ depth } 25 \text{ per cent} = \frac{\mu}{2\eta} 50.5 = 25.25 \frac{\mu}{\eta} \text{ mm.} \quad (5)$$

Perhaps the most surprising conclusion from the preceding reasoning is the realization of the fact that the percentage depth doses at a given depth as measured and reported, now convey but very little or perhaps no indication as to the therapeutic usefulness of the radiation. The actual usefulness is really indicated by the difference of doses measured directly above, and immediately beyond, the absorbing substance to be treated, *i.e.*, the tumor, and this measure is roughly proportional to the biologic result and hence to the dose absorbed in each unit of tissue or a

TABLE I.—RADIATION: CONSTANT VOLTAGE, ABOUT 180 KV. (SPHERE GAP)

Filter (mm.)	Measuring Data	Quality Coefficients	$\frac{\mu}{2\eta}$ (min. Cu)	50 per cent Dose Water G. and N. data[1] (mm.)	50 per cent Dose Water Calculated (mm.)
.25 Cu + .25 Al	$\log I_0 = 1.776$ $\log I_1 = 1.678$ $\log I_2 = 1.498$	$\mu = .920$ $\eta = .262$	1.72	50	48.3
.50 Cu + .25 Al	$\log I_0 = 1.678$ $\log I_1 = 1.607$ $\log I_2 = 1.452$	$\mu = .653$ $\eta = .133$	2.47	62	67.3
.75 Cu + .25 Al	$\log I_0 = 1.607$ $\log I_1 = 1.548$ $\log I_2 = 1.410$	$\mu = .543$ $\eta = .090$	3.02	77.7	82.6
1.0 Cu + .25 Al	$\log I_0 = 1.548$ $\log I_1 = 1.498$ $\log I_2 = 1.367$	$\mu = .488$ $\eta = .072$	3.40	94.8	92.8
2.0 Cu + .25 Al	$\log I_0 = 1.373$ $\log I_1 = 1.334$ $\log I_2 = 1.238$	$\mu = .359$ $\eta = .048$	3.74	110.0	102.4

[1] Grebe and Nitzge, Tables, 1930.

In columns 5 and 6 are shown the proportionality between the measured and the calculated depth doses in water.

cell. The above formulæ give the depth at which such doses, absorbed in unit volume or in individual cells, are sufficient for good, mediocre, or poor clinical results.

A casual application of the principle of the conservation of energy to the absorption phenomena might let it appear doubtful that the *absorbability curve* can have a minimum or a portion showing a tendency to curve upward. There are two phenomena involved in clinical therapy which make this upward bend a reasonable reality; first, the phenomenon of the dissipation of high frequency radiant energy into corpuscular components makes the terminal action connected with absorption similar to the phenomenon of ionization as disclosed by C. T. R. Wilson, Walter Bothe, and Arthur H. Compton, and it is known that the ionizing action of corpuscles is strongest at or near the end of its track. Recently Glocker (4) actually has shown that the killing effect of corpuscular rays on *Drosophila* eggs in the depth is 150 per cent of that at the surface. Second, the biologic effectiveness of very small doses is demonstrated by our ability to live exposed continuously to cosmic or terrestrial radiations, and by the now definitely accepted decay of doses or rate of repair taking place between treatments, and the many laboratory experiments which prove the ineffectiveness of very small radiation doses.

An *absorbability curve*, in so far as it relates to clinical radiation problems, actually has a minimum which can be determined with reasonable accuracy by simple absorption measurements. This point can then be numerically related, as has been done in preceding paragraphs, to various definite degrees of clinical results and thus the physically measurable quality factors may be definitely related to the depth at which these results can be obtained.

SUMMARY

1. Heterogeneous radiation measured with small ionization instruments through various absorbing thicknesses gives rise to bent, semi-logarithmic, so-called absorption curves which should be called *absorbability curves*.

2. Depth doses measured with small ionization instruments represent the product of intensity in the absorbing substance multiplied by the absorption coefficient in air, and are roughly proportional to therapeutic doses, but they give no indication of the relation of the dose absorbed in a deep-seated tumor and the dose absorbed in the normal tissues outside the tumor.

3. The doses absorbed at various depths depend not only on the measured doses but principally on the slope of the semi-logarithmic absorption curve.

4. The importance of the extent of injury to a lesion in ratio to the extent of injury to surrounding tissues as determining the quality of the therapeutic results is pointed out.

5. Clinical results and measuring data are combined and the experimental data given reveal that the best location for satisfactory clinical results is given by

$$x\,\text{mm.} = 13.7\frac{\mu}{\eta}$$

wherein μ is the linear absorption coefficient and η is the linear heterogeneity coefficient.

6. Reasons are suggested indicating why depth dose curves should have a minimum.

REFERENCES

(1) MUTSCHELLER, A.: Absorption Curves and Spectra of X-ray Beams. RADIOLOGY, **20,** 32–46, January, 1933.

(2) KAYE, G. W. C., and BINKS, W.: Experimental Realization of the Roentgen. British Jour. Radiol., **6,** 530–556, September, 1933.

(3) MEYER, WILLIAM H.: N. Y. Med. Jour., Dec. 11, 1920.

(4) GLOCKER, R.: Schnelle Elektronenstrahlen und ihre Bedeutung für die Strahlentherapie. Strahlentherapie, **53,** 417–423, 1935.

CASE REPORTS AND NEW DEVICES

ESOPHAGOPLEURAL FISTULA

REPORT OF CASE

By JOHN ROBERTS PHILLIPS, M.D., *Houston, Texas*

A fistula between the esophagus and pleura is relatively an uncommon condition. Davidson and Mills (2) reviewed the literature and reported two cases of esophageal respiratory fistula, subsequent to carcinoma of the esophagus, in 1924. Kanter and Madoff (1) recently reviewed the literature, and added a case in association with a chronic tuberculous empyema. The case that I wish to report has a fistula between the esophagus and pleura which developed three years after a mixed empyema had been drained anteriorly. This fistula has been present for five years.

A white male, 59 years of age, had a diagnosis of right pulmonary tuberculosis in 1927; pneumothorax was instituted. In 1930, empyema developed which was drained anteriorly. There has been constant purulent draining from this opening since that time. In 1933, he experienced some difficulty in swallowing, lost a good deal of weight, and after some time developed an esophagopleural fistula. At first, most of his food would run from his esophagus through his pleural sac, making its exit through the opening which was draining his empyema cavity. The escape of food through this opening was so great that he lost a good deal of weight, and in order to improve his nutrition he was fed through a nasal tube for a period of months. When the tube was withdrawn, he found that he could swallow solid food, but if he took liquids a great deal of it was lost externally. He has worn a tube in his right pleural cavity for about five years. He irrigates the food particles and purulent materials from his chest daily. His nutrition at the present time is good. He runs no fever, and although he is able to do no work, he is up and around, and takes care of himself satisfactorily. He has no cough. The blood Wassermann and the Klein and Kahn tests have always been negative. Bronchoscopic and esophagoscopic examinations are negative for tumor or ulceration. The right lung is about two-thirds col-

Fig. 1.

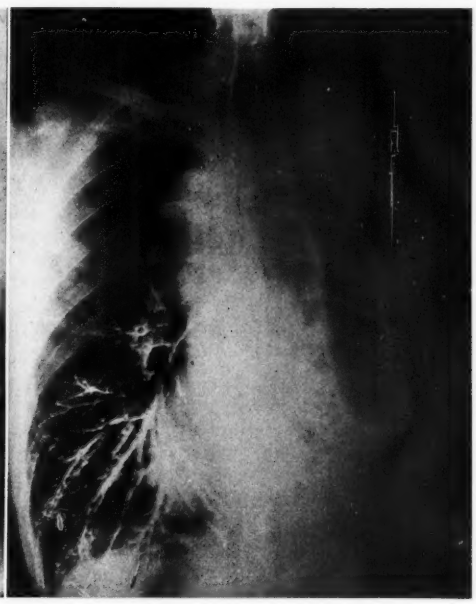


Fig. 2.

Fig. 1. Fistula between the esophagus and chronic empyema cavity is shown on the right side.
Fig. 2. Following a lipiodol injection the left bronchial tree is well visualized. There is very little lipiodol in the collapsed right lung, and none appeared in the empyema cavity.

lapsed. Barium examination of the esophagus and lipiodol injection in the trachea reveal no communication between the trachea and esophagus. There is a fairly large opening in the esophagus opposite the third dorsal vertebra. I have advised that thoracoscopy be done, and if the fistula can be visualized that an effort be made to cauterize the opening in the pleura. After this, the chronic empyema should be treated by collapse of the chest wall. Due to his age and the fact that he is getting around fairly well in his present condition, he has elected not to have any surgical procedure carried out.

At the 1938 meeting of the American Association for Thoracic Surgery, Wangensteen (3) referred to a case in which the same condition existed. His case was cured following thoracoplasty. A preliminary gastrotomy was necessary for feeding to improve nutrition.

This case is one of esophagopleural fistula in association with pyopneumothorax, undoubtedly tuberculous in origin.

BIBLIOGRAPHY

(1) KANTER, A. J., and MADOFF, I.: Esophagopleural Fistula in a Case of Tuberculous Pyopneumothorax. Am. Rev. Tuberc., **35,** 190–197, February, 1937.

(2) DAVIDSON, P. B., and MILLS, E. S.: Fistulæ between Esophagus and the Respiratory Tract. Med. Clin. N. America, **7,** 999–1017, November, 1923.

(3) WANGENSTEEN, O. H.: Personal communication.

CALCIFIED SCROTAL TUMOR

By ARCHIE FINE, M.D., *and* SAMUEL BROWN, M.D., *Cincinnati, Ohio*

From the Tumor Clinic and Department of Radiology, Jewish Hospital

Calcified scrotal masses are of such unusual frequency that they merit reporting. The particular case under consideration has additional interest because of the associated generalized lymphosarcoma.

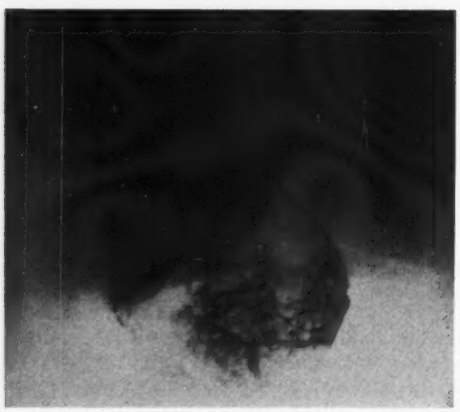


Fig. 1. A large circular mass in the scrotum, more or less calcified, suggestive of a benign lesion.

Patient L. H., male, 74 years of age, applied to the Tumor Clinic of the Jewish Hospital on Oct. 10, 1935, complaining of large lumps in the axillæ which interfered more or less with the free movements of his arms. He believed that the lumps had been present for about six months, gradually increasing to the present size. During the past three months he had noticed increasing constipation, requiring laxatives from time to time. Of late he has been troubled with a slight cough. There was no loss of appetite, weight, or strength.

Physical examination disclosed a well-developed, well-nourished elderly white man. The glands of the neck were palpable and some of them were considerably enlarged, varying from 3 to 5 cm. in diameter. The axillary glands were of enormous size, especially on the left side, so that the left arm was held away from the thorax. The glands were fairly firm in consistency, elastic, discrete, and not fixed to the surrounding tissue or skin. There was no tenderness upon pressure. The abdomen was moderately distended. Upon deep palpation numerous masses were felt along the spinal column which were assumed to be due to enlarged retroperitoneal glands. The inguinal glands were palpable but not enlarged. Auscultation revealed very noisy peristalsis. The scrotum was considerably enlarged, there being a mass present on the right side measuring about 12 cm. in diameter, thought to originate in the right testicle. It was quite heavy and insensitive to pressure. Transillumination showed it to be opaque. The patient said that the mass had been present about two years.

The urine examination revealed nothing unusual. The red blood cell count was 4,500,000, the white 5,300; differential was normal.

The x-ray examination of the chest and abdomen presented the following: enlarged glands were noted in the hilar region; the anterior mediastinal region was obscured by a mass in front of the arch of the aorta; the left costophrenic angle was obliterated by a collection of fluid; the lungs were free from metastases. Gastro-intestinal examination showed anterior displacement of the stomach, apparently as a result of a retroperitoneal mass.

The first impression was that this was a case of malignant degeneration of a teratoma testis with generalized metastases. However, it seemed rather strange that the metastases involved only the lymph nodes. A diagnosis of lymphosarcoma was also considered. Biopsy of the right axillary nodes revealed a small round-cell tumor which could not be distinguished from lymphosarcoma. However,

many tumors of the testis of the seminoma type may resemble lymphosarcoma histologically to such a degree that differentiation may be difficult.

Roentgen therapy was instituted. The enlarged glands of the neck, axillæ, and mediastina responded rapidly. The pleural fluid entirely disappeared and the retroperitoneal mass retrogressed to a marked degree within a short time after treatment. Each field received 1,000 r units with the following factors: 200 kv., 25 ma., 0.5 mm. Cu filter, distance 50 cm. The scrotal tumor, notwithstanding a total dose of 5,000 r units, failed to show the slightest response to treatment. Accordingly, it was decided to make an x-ray examination of the scrotum, whereupon a large circular mass was disclosed, more or less calcified (Fig. 1), suggestive of a benign lesion.

DISCUSSION

As to the duration of the existence of this tumor there was a difference of opinion between the husband and wife. The former claiming only two years' existence, while the latter said that it had been present at least twenty years.

As to the origin of the mass in the scrotum, most likely it is an old hydrocele which subsequently calcified. Not unlikely it may have been a hematocele which, instead of being absorbed, became organized. Metaplasia of the connective tissue cells into osteoblasts may have occurred, with formation of bone. According to Kaufmann (1), sacs of old hydroceles may become thick and leathery and covered with irregular cartilaginous or calcareous deposits. Kickham (2, 3) has described two cases of calcified scrotal hydrocele, both of which were excised. One had been present 40 years in a man of 80 years; the other, in a man of 41, was believed to be malignant. Both presented calcified plaques in the wall, the testis being normal. Toulson (4) has also described a case in a man of 23, the tumor having been present four years. Young and Waters (5) have also described and illustrated a case of calcified scrotal hydrocele.

The lack of response to radiation led us to suspect the scrotal tumor was benign. The x-ray examination confirmed this finding. If this examination had been performed when the patient was first seen, the correct diagnosis would have been made and unnecessary radiation avoided.

CONCLUSION

A case of calcified scrotal tumor is described. The correct diagnosis was made possible only after the roentgen-ray examination, which revealed calcified deposits. The failure of this tumor to respond to x-ray treatment also served to indicate that the lesion was of benign origin. The patient had, in addition, a generalized lymphosarcoma which yielded readily to roentgen therapy. The man remained well until July 8, 1937. The exact cause of his death could not be ascertained.

REFERENCES

(1) KAUFMANN: Pathology, **2**, 1513; P. Blakistons' Son, Philadelphia.
(2) KICKHAM, C. J. E.: New Eng. Jour. Med., **208**, 869, April 27, 1933.
(3) Idem: New Eng. Jour. Med., **212**, 419–420, March 7, 1935.
(4) TOULSON, W. H.: British Jour. Urol., **28**, 247–250, August, 1932.
(5) YOUNG, HUGH H., and WATERS, CHARLES A.: Urological Roentgenology, p. 460; Paul B. Hoeber, New York.

RUPTURE OF THE ESOPHAGUS FROM A BLOW ON THE ABDOMEN

By C. A. ALDRICH, M.D., *Winnetka, Illinois, and* W. E. ANSPACH, M.D., *Chicago*

The literature records innumerable instances of perforation of the esophagus by foreign bodies either because of the nature of the foreign body or by accident during the use of the esophagoscope. Perforation by caustics has occurred frequently. Aneurysm and neoplasm, as well, have been prominent etiologic factors in esophageal perforation in adults. However, rupture of the esophagus from external trauma has been unusually rare. A search through the Cumulative Index failed to reveal a record of a case in which the esophagus was ruptured from a blow on the surface of the body. The findings of such a case prompted us to make the following report:

Report of Case.—J. E., male, four and one-half years of age, was admitted to the Highland Park Hospital, Oct. 28, 1936, by W. E. Richberg, M.D., suffering from shock, pallor, severe pain, and board-like rigidity of the abdomen following an injury. A few hours previously, the child had climbed upon a stone mantelpiece which, becoming dislodged, had caused him to fall to the floor in such a way that the heavy mantelpiece landed across the upper portion of his abdomen. At the time of admission the pulse was 130, the temperature 104 degrees. An x-ray examination of the chest made eight hours following the accident showed a pneumothorax on the right side with a partially collapsed lung (Fig. 1). The possibility that this had been caused by a fractured rib was considered, but no fracture could be located. A thoracentesis was done and air was withdrawn. Because of the marked abdominal tenderness and rigidity, it was thought that an injury to the intestinal

tract, possibly a perforation, had occurred. A laparotomy was performed by Gatewood but no demonstrable lesion was found. The stomach, small intestine, and colon appeared normal, but a small amount of blood was seen trapped air, whereas in this instance there was no suggestion that the air in the pleural cavity was under pressure. Large openings into the pleural cavity produce only partial collapse of the lung as there is free exchange of air between

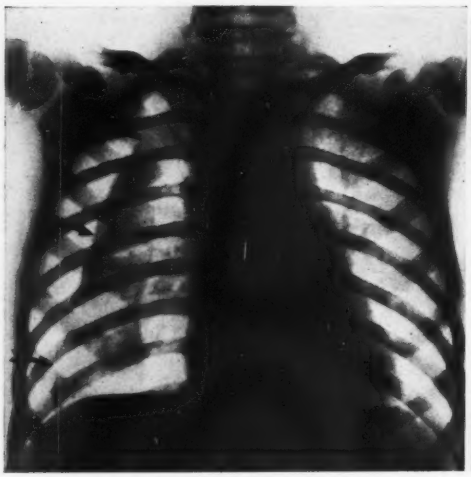


Fig. 1.

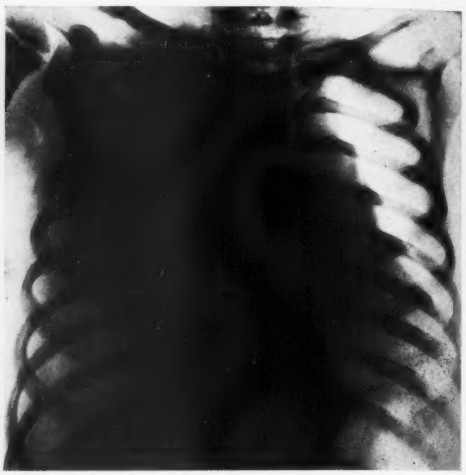


Fig. 2.

Fig. 1. X-ray appearance eight hours after a blow on the abdomen. The right lung is only partially collapsed. Air is free to enter the pleural cavity through large openings in the esophagus.
Fig. 2. Same case, the following day. Complete blotting out of right hemithorax by food in the pleural cavity.

through the intestinal wall, within the lumen of the intestine. The patient stood the operation satisfactorily but his general condition remained poor. At this time the patient was seen by one of us (C. A. A.) in consultation. The following day the physical findings in the right half of the thorax changed. Instead of tympany there was marked dullness. A chest roentgenogram (Fig. 2) showed the right lung-field blotted out, apparently by fluid. A thoracentesis now revealed that the pleural cavity contained gastric contents. A diagnosis of ruptured esophagus was made. The child's temperature rose to 108 degrees without showing any relief of earlier symptoms, and death occurred within 48 hours from the time of the accident.

At necropsy the viscera showed no marked change except that two large holes were found in the lower third of the esophagus above the diaphragm. This allowed free communication between the lumen of the esophagus and the right pleural cavity.

Comment.—The early diagnostic interest in this case centered about the first chest roentgenogram because most injuries to the thorax in young children, which perforate the lung, produce a positive pressure pneumothorax from the pleural space and the outside, but the remote location of the injury did not cause this condition to be considered at this time. The absence of a fractured rib, the most common cause of large tears in the lung tissue, added to the confusion. Later, the surgeons' inability to locate a perforated viscus below the diaphragm and the presence of blood in the intestinal lumen seemed to indicate a lesion higher up in the gastro-intestinal tract. The second thoracentesis, at which time gastric content was withdrawn from the pleural cavity, added final evidence of a ruptured esophagus.

One can only speculate as to why the sudden impact of the heavy stone mantel upon the abdomen should rupture the esophagus rather than the stomach. It seems most probable that the blow was directed in such a way that the sudden impact on the stomach was transferred with terrific force *via* stomach content to the esophagus. The rupture occurred just above the diaphragm, at what appears to be the most vulnerable portion of the esophagus. At this level the esophagus is in close contact with the pleura and is less protected by neighboring supporting structures than at a higher level. It is interesting in this connection

to note that there was no air in the mediastinal space at necropsy, as would be expected had the perforation occurred slowly or had the opening been small.

A roentgen study of the different kinds of pneumothorax in the living frequently offers a clue to the size of the opening between the pleural cavity and the outside. An almost microscopic opening is indicated by marked ballooning out of the pleural cavity (Fig. 3). A somewhat larger opening has only a slight tendency to collapse the lung during expiration as a momentary increase in the intrapleural pressure takes place. There is no prolonged trapping of air. This can best be determined by fluoroscopic observation. A large opening in the pleural cavity, which allows the free ingress and egress of air, is indicated by the stationary size of the partially collapsed lung during both inspiration and expiration. At all times the lung is in a state of only moderate collapse.

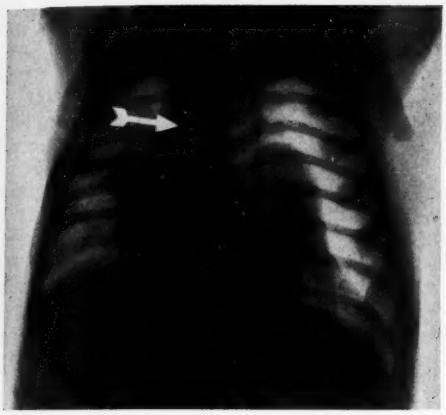


Fig. 3. Positive pressure pneumothorax due to needle puncture in an infant. Note the high degree of collapse of the left lung and marked displacement of the mediastinal structures to the opposite side. Death occurred within two hours. The appearance here is in contrast to the partial collapse in the presence of large openings as in rupture of the esophagus (Fig. 1).

The appearance presented at the first x-ray examination (Fig. 1) is approached often on postmortem roentgenograms of the chest in children when digestion from stomach secretions dissolves away a portion of the esophagus. The frequency with which this occurs is greater when the time of necropsy is delayed following death.

Summary.—A case of rupture of the esophagus following a blow on the abdomen is reported. A large opening between the pleural cavity and the outside was indicated at the time of the first x-ray examination, but its full significance was not realized. Later, blood seen in the intestinal lumen during a laparotomy and subsequently the finding of gastric content in the pleural cavity made the diagnosis. Death occurred within 48 hours and a postmortem revealed two large openings in the esophagus just above the cardia. These permitted free communication between the esophagus and the pleural cavity and presented the roentgen picture usually seen when there are large openings between a bronchus and the pleural cavity. The case is reported because of the unusual diagnostic problem presented and because of the rarity of the lesion.

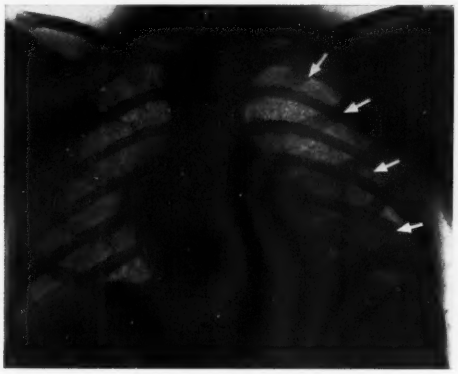


Fig. 4. Necropsy film on a child four and one-half years of age. Pneumothorax with partial collapse of the left lung due to a hole in the esophagus due to postmortem digestion. This has been a frequent finding on necropsy films at the Children's Memorial Hospital, Chicago, where routine necropsy roentgenograms are made.

ROENTGEN EPILATION

By ERNST ARONSTEIN, M.D., *Fresno, California*

The roentgenologist who faces the problem of obtaining a reliable epilation of the entire scalp is still guided by the four-fields method of Kienböck-Adamson in most of the current text-books. This is the more surprising since this method was worked out when superficial therapy was applied with the open tube stand at the distance of from 20 to 27 cm.

Certainly the Kienböck-Adamson method has had its merits and epidemics of Celsus' kerion infection have been rooted out in France by this method. However, it should be replaced by a simpler and less dangerous method which I recently carried out with good results and which I will describe.

The patient is first placed on one side in the true lateral position. Lead rubber is used to cover the patient's face and eye which face the tube, the upper and posterior border of the lead rubber having been cut out to follow the patient's lower and anterior hair border. The tube's focus is placed at the distance of 80 cm. from the uppermost hair. The patient is given x-rays through a diaphragm which will cover an area larger than the skull. On my equipment (a Wappler-drum) a round diaphragm of 12 cm. diameter, located 32 cm. from the tube's focus so that the size of the area covered was 30 cm. in diameter, was used. The patient is given 425 r measured in air without the filter. The exact data in my particular case were: 122 kv., 8 ma., 80 cm. focus-skin distance, 0 filter, diaphr. No. I, 25 min. The same procedure is then done with the patient lying on the opposite side.

Assuming that the patient's skull has a bitemporal diameter of 10 cm., the hair situated lowest which would be radiated would be at a 85 cm. distance from the tube's focus, so that the amount of radiation to the more distant hair would still be 376 r—enough to effect an epilation. This assumption applies to infants and small children. To adolescent and adult skulls we may apply, without danger, 475 r to the uppermost point. Assuming that the skull's bitemporal diameter amounts to 15 cm., this would still leave 397 r to the more distant hair.

This method requires a longer exposure time than the four-fields method, but it reduces the number of fields to two. It also markedly reduces the amount of painstaking preparation necessary in using the old method, and it reduces the awkward positioning of the patient and of the tube. It reduces the danger as far as the contact with the high tension is concerned, and minimizes the possibilities of overlapping or missing certain areas. Its advantages are, therefore, obvious.

A TABLE FOR USE IN THE RADIOGRAPHY OF INFANTS' CHESTS[1]

By HANS GEISSBERGER, R.T., Vanderbilt University Hospital, *Nashville, Tenn.*

A simply constructed device which may be used to immobilize an infant in the upright position is shown in Figures 1 and 2. It consists of an ordinary table with holes cut through the top so as to allow the baby's feet and legs to hang below. At right-angles to the top of this table, a vertical, wooden cassette

[1] Accepted for publication Nov. 15, 1937.

Fig. 1.

holder is permanently mounted. The patient is placed with his legs through the holes and the body against the cassette, and immobilized by the cloth and ratchet device as shown.

The cassette holder is constructed so as to hold an 8 × 10 cassette on one side and a 10 × 12 cassette on the other. The leg holes on the 10 × 12 side are made correspondingly larger than those on the 8 × 10 side.

The construction of this table is simple and inexpensive and may be easily duplicated from the photographs shown. For over a year its operation at this institution has proven entirely satisfactory.

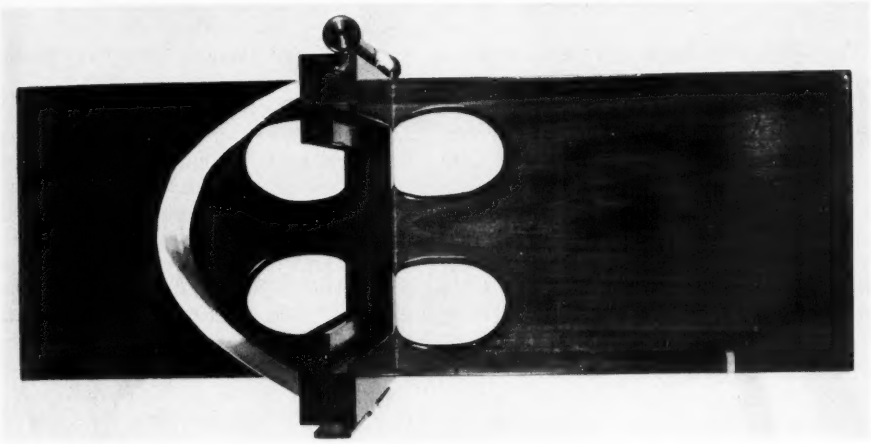


Fig. 2

THE GENERAL WELFARE OF RADIOLOGY

From time to time activities by local radiological groups or county and state medical societies result in important contributions to the general welfare of radiology. Such is the report, reprinted below, which was adopted by the Medical Society of New Jersey at the 1938 session of its House of Delegates. Entitled "Supplementary Report Relating to Hospital Insurance," the report was prepared by the Auxiliary Medical Services Committee of the State Society. William W. Maver, M.D., of Jersey City, was Chairman.

For a clear analysis of the problems arising in hospital-radiologist relationships and a definite proposal for solution, the report is worthy of study by radiologists and medical societies in other States. In future issues of the Inter-Society Committee Bulletin, important projects of interest to radiology in other localities will be reported.

Deleted of special sections devoted to pathology, anesthesia, and physical therapy, the full report, as approved by the Medical Society of New Jersey, follows:

"Throughout its deliberations, as well as in the formation of this report, the Committee on Auxiliary Medical Services has felt that it should in large measure be guided by the principles laid down by the House of Delegates of the American Medical Association during the 1937 convention at Atlantic City.

"The resolution adopted at that time may well be cited here and is appended.

" 'In the matter of hospital insurance plans it has been alleged that the outstanding obstacle to the formation of a plan satisfactory to the medical profession as well as to the patient and the hospital, is the salaried specialist. In other words, it has been stated that, as long as the hospitals, through the employment of clinical pathologists, roentgenologists, anesthetists, and physical therapeutists as whole or part-time specialists working solely or in part on a salary basis, are thus enabled to furnish patients with such services, it is difficult to object to the furnishing of these same services as a part of a hospital insurance plan.'

"Your Committee as a whole is prepared to recognize that there is both some justice and some validity to this contention.

"It is more prepared to do so because it desires to emphasize, first, that such financial arrangements are not satisfactory from the standpoint of the specialists concerned; and second, that the existence of this custom is a heritage from the past.

"It seems essential, for the purposes of this discussion, to point out that the specialized departments in question, constitute not only valuable but essential departments of the hospital. Not only are they essential and a vital concomitant of the modern practice of medicine, but they play an important and equally essential part in its continued development.

"It is also essential to recognize that the men engaged in these specialties are, and must be, first of all physicians, and secondly, physicians whose energies and training have been directed toward the attainment of specialized skill in specialties of medical practice as specific and distinct as surgery, obstetrics, or any other specialized entity.

"It is important that this be emphasized, for there has been some tendency in the past, which may even yet still exist in varying degrees, to the effect that the pathologist was merely an individual who made 'tests,' the roentgenologist one who took 'pictures,' the anesthetist one who merely administered a drug and so on. The corollary to this was that, thus regarded as supernumerary adjuncts, they could, to a greater or lesser degree, be more or less efficiently replaced by technical assistants of greater or lesser training in various technical procedures and manipulations.

"Lest it be thought that this is an extreme or exaggerated viewpoint, it can be maintained with small fear of contradiction that some such idea, or variation of it, is not infrequent in the minds of some hospital administrators and —paradoxical as it may seem—may even be encountered among physicians.

"While it should be unnecessary, it seems nevertheless advisable to recall with some emphasis that the function of the pathologist or the roentgenologist is not, for the one to make 'tests,' or the other 'pictures.' Both are pri-

marily not only liaison officers between the laboratory and bedside and the patient and the physician, but they may properly be regarded as consultants.

"The real value of the roentgenologist depends, not upon his ability to produce a set of x-ray films, but upon his ability—which, in turn, is dependent upon his ability as a physician—to know *what* examination should be made and how, and most particularly upon his ability to interpret its significance which often involves no mean degree of clinical acumen.

"The real value of the pathologist depends, not upon his facility in technical manipulations nor to supervise their performance by others, but upon his ability to determine, not only which procedure may be most profitably utilized, but especially upon his ability to interpret its clinical significance and evaluation, which, as before, may demand no small degree of clinical ability.

"The real value of an anesthetist depends, not upon his ability to pour ether or chloroform into an inhaler, to operate a machine for the purpose, or to administer a drug intravenously or by lumbar puncture, but upon his ability to select the method suitable to the particular circumstances and to recognize its dangers, fallacies, and limitations; and here, again, without clinical acumen and training the anesthetist is lost—and the patient may well be."

The same principles apply to all similar specialties.

All this being true, as cannot successfully be denied, a salary basis for such specialties is seldom, if ever, satisfactory. First, because the salary is seldom, if ever, commensurate with the importance of the specialty, and, second, because in striking contradistinction to other branches of medicine, no matter how their specialists may increase in skill or reputation, thus becoming a greater and more valuable asset to the institution, the salary has a definitely static tendency and undergoes but infrequent and reluctant changes.

For these reasons, as well as others which obviously develop from the premises laid down above, the Committee strongly deprecates the hamstringing of these specialties of medical practice by the custom more or less generally adhered to, and, by the same token, deprecates with equal emphasis the effect of this situation upon the development of satisfactory plans for hospital insurance.

The Committee desires, therefore, to record its entire accord with the principle that *the services of physicians should not be a part of any plan for hospital insurance*, and to record also its specific and vigorous objection to the inclusion in such plans of the services of pathologists, roentgenologists, anesthetists, and physical therapists.

The specific problem before the Committee, however, is not merely to express disapproval of such plans but to propose a working outline that will eliminate medical services from Hospital Insurance Contracts.

It is apparent, of course, that the solution of this problem is neither easy, obvious, nor to be rapidly evolved.

From what has been said, it is apparent that these suggestions must embody, first of all, some method whereby the salaried specialists, as such, may be eliminated from the hospital economy. As these various departments differ in their nature and method of functioning, it is necessary that they be separately considered.

THE DEPARTMENT OF RADIOLOGY

The practice of radiology in hospitals is essentially the same as the private practice of this specialty. The radiologist practises his specialty in the same manner as other specialists in the hospital, with the exception that his apparatus is of such a nature that it cannot be moved about readily.

In many instances, the early practice of radiology in hospitals was accomplished by the installation of x-ray equipment by the radiologist, who bore the entire financial burden and received the entire income. The use of hospital space was compensated for by free services to ward patients.

Many changes have occurred since the original plan, and for various reasons either a salary or a commission basis of financial return has been quite generally adopted. In spite of the disadvantages that may have existed under the salary or commission arrangement, affecting either the hospital or the radiologist, an attitude of consideration has been maintained, and on the whole, cordial relationships have been the rule rather than the exception.

However, with the advent of Hospital Insurance plans which include radiological services, there has crystallized a definite sense of resistance on the part of radiologists who rightfully feel that their specialty is undergoing exploitation by a third party. Injection of this third party has not only disrupted existing relationships, but has emphasized the necessity for the hospitals to agree to practise hospitaliza-

tion and to permit the practice of medicine to remain in the hands of those licensed by law to practise medicine.

A solution of the problem that will prevent a third party from injecting itself into medical practice, and at the same time protect the status of radiology in hospital practice, is the one that, in our opinion, is entitled to the support of the Medical Society of New Jersey.

Such a solution is practical under the lease-rental agreement between the hospital and the radiologist. This, in its essentials, is exemplified in the Washington Plan, and consists of an arrangement whereby

(1) The radiologist rents space from the hospital, as in an office building, and supplies the equipment and personnel to operate the department, *or*

(2) The radiologist rents space and leases the equipment by arranging a "per examination" monthly rebate to the hospital to cover depreciation, obsolescence, and overhead.

(3) The radiologist bills the patient direct, on his own billhead, and assumes full responsibility for his financial return, exactly as in private practice.

(4) Should the hospital be obligated to perform free work, the services of the radiologist are contributed free, and the hospital compensates him for the expendable material expense as in examinations of "free patients" and as in the routine examination of internes, pupil nurses, and hospital employees.

The lease-rental arrangement for radiological services in hospitals is a workable plan and is in practice in the following hospitals in the United States:

Garfield Hospital, Washington, D. C.

Good Samaritan Hospital, Los Angeles, Cal.

Temple University Hospital, Philadelphia, Pa.

Cottage Hospital, Santa Barbara, Cal.

Queen of Angels Hospital, Los Angeles, Cal.

University of Pennsylvania Hospital, Philadelphia, Pa.

To quote from the report of the Executive Committee of the Pacific Roentgen Club, the advantages of this plan to the hospital and to the radiologist are as follows:

To the Hospital

"(*a*) It puts the relation of the hospital and of certain members of its medical staff on an ethical and equitable basis, encouraging the selection of the radiologist solely on the basis of competence (unbiased by the percentage or salary to which he might agree).

"(*b*) It removes the question of division of fees, practice of medicine by a corporation, and so forth.

"(*c*) It insures a more competent type of radiological service without additional cost to the hospital. The radiological department becomes increasingly a 'feeder' to the hospital because of the fact that a good radiologist builds up a clientele of his own and attracts not only good men in the profession to use the hospital, but also hospitalizes many treatment cases of his own.

"(*e*) It removes from the hospital any question of suit for liability in connection with medical x-ray service and care.

"(*f*) It provides what is said by one of the most eminent physicians in this country to be the only permanent and satisfactory solution to the problem of hospital radiological work."

To the Radiologist

"(*a*) It places the appointment of the physician-radiologist on the same ethical and legal professional basis as other individual doctors on the staff.

"(*b*) It removes the question of division of fees.

"(*c*) It stimulates the hospital radiologist to build up his practice on the proper basis, namely, that of personal skill and ability.

"(*d*) It places the responsibility for the operation of an efficient radiological practice where it should be placed, namely, with the physician.

"(*e*) It tends to place the economic status of the radiologist on a level comparable with that of his fellow-practitioners and consultants and thereby encourages better men to enter the field."

In consideration of the foregoing, your Committee desires to record the following specific recommendations for the practice of radiology in hospitals in the State of New Jersey.

I. Every hospital radiological department should be under the direction of a competent radiologist, preferably a diplomate of the American Board of Radiology or one who is working toward that objective.

II. The radiologist should be a member of the senior attending staff.

III. The services of the radiologist should be available, without specific charge, to those hospital patients classed as "free patients."

IV. The plan suggested by this Committee eliminates salary or percentage basis arrangements for radiologists in hospitals, and recommends a lease-rental arrangement for space or equipment, or both.

V. In accordance with Resolutions adopted by the American Medical Association, the principles of which are binding upon the component organizations of this Association, radiology should be treated the same as other specialties (surgery, urology, orthopedics, etc.) in any insurance plan.

SUMMARY

In recapitulation the consensus of this Committee may thus be summarized:

1. It is in entire accord with the principles laid down by the House of Delegates of the American Medical Association.

2. It is opposed to the inclusion in hospital insurance plans of the services of physicians engaged in specialized phases of the practice of medicine, specifically, clinical pathology, roentgenology, anesthesia and physical therapy.

3. It appreciates the undesirable features of the practice of these specialties on a salaried basis.

4. It, therefore, presents as suggestions for adoption or discussion, various methods whereby this undesirable feature may be eliminated, such methods necessarily varying in connection with the particular specialty involved and being subject to such modifications as may be determined upon between the particular physician and the particular institution involved—always, however, with the provision that such specialties shall not be practised on a salary basis.

5. It emphasizes the essential necessity, in the event of further consideration of this subject, of including among those to whom this problem may be hereafter presented, representatives of the specialties in question.

MAC F. CAHAL
Executive Secretary

RADIOLOGICAL SOCIETIES IN THE UNITED STATES

Editor's Note.—Will secretaries of societies please cooperate with the Editor by supplying him with information for this section? Please send such information to Leon J. Menville, M.D., 1201 Maison Blanche Bldg., New Orleans, La.

CALIFORNIA

California Medical Association, Section on Radiology.—Chairman, Karl M. Bonoff, M.D., 1930 Wilshire Blvd., Los Angeles; *Secretary,* Carl D. Benninghoven, M.D., 95 S. El Camino Real, San Mateo.

Los Angeles County Medical Association, Radiological Section.—President, John F. Chapman, M.D., 65 N. Madison Ave., Pasadena; *Vice-president,* E. N. Liljedahl, M.D., 1241 Shatto St.; *Secretary,* Merl L. Pindell, M.D., 678 South Ferris Ave.; *Treasurer,* Henry Snure, M.D., 1414 Hope Street. Meets every second Wednesday of month at County Society Building.

Pacific Roentgen Club.—Chairman, Lyell C. Kinney, M.D., San Diego; *Secretary,* L. Henry Garland, M.D., 450 Sutter Street, San Francisco. Executive Committee meets quarterly; Club meets annually during annual session of the California Medical Association.

San Francisco Radiological Society.—Secretary, L. H. Garland, M.D., 450 Sutter Street. Meets monthly on first Monday at 7:45 P.M., alternately at Toland Hall and Lane Hall.

COLORADO

Denver Radiological Club.—President, F. B. Stephenson, 452 Metropolitan Bldg.; *Vice-president,* K. D. A. Allen, M.D., 452 Metropolitan Bldg.; *Secretary,* E. A. Schmidt, M.D., 4200 E. Ninth Ave.; *Treasurer,* H. P. Brandenburg, M.D., 155 Metropolitan Bldg. Meets third Tuesday of each month at homes of members.

CONNECTICUT

Connecticut State Medical Society, Section on Radiology.—Chairman, Ralph T. Ogden, M.D., 179 Allyn St., Hartford; *Secretary-Treasurer,* Max Climan, M.D., 242 Trumbull St., Hartford. Meetings twice annually in May and September.

DELAWARE

Affiliated with Philadelphia Roentgen Ray Society.

FLORIDA

Florida Radiological Society.—President, H. O. Brown, M.D., 404 First National Bank Bldg., Tampa; *Vice-president,* H. B. McEuen, M.D., 126 W. Adams St., Jacksonville; *Secretary-Treasurer,* J. H. Lucinian, M.D., 168 S. E. 1st St., Miami.

GEORGIA

Georgia Radiological Society.—President, James J. Clark, M.D., Doctors Bldg., Atlanta; *Vice-president,* William F. Lake, M.D., Medical Arts Bldg., Atlanta; *Secretary-Treasurer,* Robert C. Pendergrass, M.D., Prather Clinic, Americus. Meetings twice annually, in November and at the annual meeting of the Medical Association of Georgia in the spring.

ILLINOIS

Chicago Roentgen Society.—President, David S. Beilin, M.D., 411 Garfield Ave.; *Vice-president,* Chester J. Challenger, M.D., 3117 Logan Blvd.; *Secretary-Treasurer,* Roe J. Maier, M.D., 7752 Halsted St. Meets second Thursday of each month, September to May, except December.

Illinois Radiological Society.—President, Cesare Gianturco, M.D., 602 W. University Ave., Urbana; *Vice-president,* Fred H. Decker, M.D., 802 Peoria Life Bldg., Peoria; *Secretary-Treasurer,* Edmund P. Halley, M.D., 968 Citizens Bldg., Decatur. Meetings quarterly by announcement.

Illinois State Medical Society, Section on Radiology.—The next meeting will be May 2, 3, 4, 1939, to be held in Rockford. The officers of the Section for the coming meeting are Harry B. Magee, M.D., of Peoria, *Chairman,* and Warren W. Furey, M.D., 6844 Ogleby Ave., Chicago, *Secretary.*

INDIANA

Indiana Roentgen Society.—President, Stanley Clark, M.D., 108 N. Main St., South Bend; *President-elect,* Juan Rodriguez, M.D., 2903 Fairfield Ave., Fort Wayne; *Vice-president,* A. C. Holley, M.D., Attica; *Secretary-Treasurer,* Clifford C. Taylor, M.D., 23 E. Ohio St., Indianapolis. Annual meeting in May.

IOWA

The Iowa X-ray Club.—Holds luncheon and business meeting during annual session of Iowa State Medical Society.

MAINE

See New England Roentgen Ray Society.

MARYLAND

Baltimore City Medical Society, Radiological Section.—Chairman, Whitmer B. Firor, M.D., 1100 N. Charles St.; *Secretary,* Walter L. Kilby, M.D., 101 W. Read St. Meetings third Tuesday of each month.

MASSACHUSETTS

See New England Roentgen Ray Society.

MICHIGAN

Detroit X-ray and Radium Society.—President, Sam W. Donaldson, M.D., 326 N. Ingalls St., Ann Arbor;

Vice-president, Clarence Hufford, M.D., 421 Michigan Ave., Toledo, Ohio; *Secretary-Treasurer*, E. R. Witwer, M.D., Harper Hospital, Detroit. Meetings first Thursday of each month from October to May, inclusive, at Wayne County Medical Society club rooms, 4421 Woodward Ave.

Michigan Association of Roentgenologists.—President, E. R. Witwer, M.D., Harper Hospital, Detroit; *Vice-president*, D. W. Patterson, M.D., 622 Huron Street, Port Huron; *Secretary-Treasurer*, C. K. Hasley, M.D., 1429 David Whitney Bldg., Detroit. Meetings quarterly by announcement.

MINNESOTA

Minnesota Radiological Society.—President, Walter H. Ude, M.D., 78 S. 9th St., Minneapolis; *Vice-president*, Leo G. Rigler, M.D., University Hospitals, Minneapolis; *Secretary-Treasurer*, Harry Weber, M.D., 102 Second Ave., S. W., Rochester. Meetings quarterly.

MISSOURI

The Kansas City Radiological Society.—President, L. G. Allen, M.D., 907 N. 7th St.. Kansas City, Mo.; *Secretary*, Ira H. Lockwood, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Thursday of each month.

The St. Louis Society of Radiologists.—President, Paul C. Schnoebelen, M.D.; *Secretary*, W. K. Mueller, M.D., University Club Bldg. Meets on fourth Wednesday of October, January, March, and May, at a place designated by the president.

NEBRASKA

Nebraska Radiological Society.—President, T. T. Harris, M.D., Clarkson Memorial Hospital, Omaha; *Secretary*, D. Arnold Dowell, M.D., 117 S. 17th St., Omaha. Meetings first Wednesday of each month at 6 P.M. in Omaha or Lincoln.

NEW ENGLAND ROENTGEN RAY SOCIETY

(Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island.) *President*, Frank E. Wheatley, M.D., 520 Beacon St., Boston; *Secretary*, E. C. Vogt, M.D., 300 Longwood Ave., Boston. Meetings third Friday of each month from October to May, inclusive, usually at Boston Medical Library.

NEW HAMPSHIRE

See New England Roentgen Ray Society.

NEW JERSEY

Radiological Society of New Jersey.—President, Milton Friedman, M.D., 31 Lincoln Park, Newark; *Vice-president*, P. S. Avery, M.D., 546 Central Ave., Bound Brook; *Secretary*, W. James Marquis, M.D., 198 Clinton Ave., Newark; *Treasurer*, James Boyes, M.D., 744 Watchung Ave., Plainfield. Meetings at Atlantic City at time of State Medical Society, and Midwinter in Newark as called by president.

NEW YORK

Brooklyn Roentgen Ray Society.—President, Albert Voltz, M.D., 115–120 Myrtle Avenue, Richmond Hill; *Vice-president*, A. L. L. Bell, M.D., Long Island College Hospital, Henry, Pacific, and Amity Sts., Brooklyn; *Secretary-Treasurer*, E. Mendelson, M.D., 132 Parkside Ave., Brooklyn. Meetings first Tuesday in each month at place designated by president.

Buffalo Radiological Society.—President, Walter Mattick, M.D., 101 High St.; *Vice-president*, Chester Moses, M.D., 333 Linwood Ave.; *Secretary-Treasurer*, J. S. Gian-Franceschi, M.D., 610 Niagara Street. Meetings second Monday evening each month, October to May, inclusive.

Central New York Roentgen-ray Society.—President, W. E. Achilles, M.D., 60 Seneca St., Geneva; *Vice-president*, M. T. Powers, M.D., 250 Genesee St., Utica; *Secretary-Treasurer*, Carlton F. Potter, M.D., 425 Waverly Ave., Syracuse. Meetings held in January, May, and October as called by Executive Committee.

Long Island Radiological Society.—President, Samuel G. Schenck, M.D., Brooklyn; *Vice-president*, G. Henry Koiransky, M.D., Long Island City; *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn; *Treasurer*, Louis Goldfarb, M.D., 608 Ocean Ave., Brooklyn. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

New York Roentgen Society.—President, Raymond W. Lewis, M.D., 321 E. 42nd St., New York City; *Vice-president*, Henry K. Taylor, M.D., 667 Madison Ave., New York City; *Secretary*, Roy D. Duckworth, M.D., 170 Maple Ave., White Plains; *Treasurer*, Eric J. Ryan, M.D., St. Luke's Hospital, New York City; *Member of Executive Committee*, E. Forrest Merrill, M.D., 30 W. 59th St., New York City. Meetings third Monday evening each month at Academy of Medicine.

Rochester Roentgen-ray Society.—Chairman, Joseph H. Green, M.D., 277 Alexander St.; *Secretary*, S. C. Davidson, M.D., 277 Alexander St. Meetings at convenience of committee.

Associated Radiologists of New York, Inc.—President, Albert L. Voltz, M.D., 115–120 Myrtle Ave., Richmond Hill; *Vice-president*, M. M. Pomeranz, M.D., 911 Park Ave., New York City; *Secretary*, W. J. Francis, M.D., 121 Madison Ave., New York City; *Treasurer*, Theodore West, M.D., United Hospital, Port Chester. Meetings first Monday evening each month at McAlpin Hotel.

NORTH CAROLINA

Radiological Society of North Carolina.—President, Robert P. Noble, M.D., 127 W. Hargett St., Raleigh; *Vice-president*, A. L. Daughtridge, M.D., 144 Coast Line St., Rocky Mount; *Secretary-Treasurer*, Major I. Fleming, M.D., 404 Falls Road, Rocky Mount. Meetings with State meeting in May, and meeting in October.

OHIO

Cleveland Radiological Society.—President, John Heberding, M.D., St. Elizabeth's Hospital, Youngstown; *Vice-president,* R. V. May, M.D., St. Luke's Hospital, Cleveland; *Secretary-Treasurer,* Harry Hauser, M.D., City Hospital, Cleveland. Meetings at 6:30 P.M. at the Mid-day Club, in the Union Commerce Bldg., on fourth Monday of each month from October to April, inclusive.

Radiological Society of the Academy of Medicine (Cincinnati Roentgenologists).—*President,* B. M. Warne, M.D., Doctors Building, Cincinnati; *Secretary-Treasurer,* Justin E. McCarthy, M.D., 707 Race St., Cincinnati, Ohio. Meetings held third Tuesday of each month.

PENNSYLVANIA

Pennsylvania Radiological Society.—President, Charles S. Caldwell, M.D., 520 S. Aiken Ave., Pittsburgh; *First Vice-president,* Thomas L. Smyth, M.D., 111 N. 8th St., Allentown; *Second Vice-president,* Reuben G. Alley, M.D., Western Pennsylvania Hospital, Pittsburgh; *Secretary-Treasurer,* Lloyd E. Wurster, M.D., 416 Pine St., Williamsport; *President-elect,* Louis A. Milkman, M.D., 212 Medical Arts Bldg., Scranton; *Editor,* William E. Reiley, M.D., Clearfield. Annual meeting, May, 1939. Exact date and place to be decided.

Philadelphia Roentgen Ray Society.—President, Thomas P. Laughery, M.D., Germantown Hospital; *Vice-president,* Elwood E. Downs, M.D., Jeans Hospital, Fox Chase; *Secretary,* Barton H. Young, M.D., Temple University Hospital; *Treasurer,* R. Manges Smith, M.D., Jefferson Hospital. Meetings first Thursday of each month from October to May, Thompson Hall, College of Physicians, 19 S. 22nd St., 8:15 P.M.

The Pittsburgh Roentgen Society.—President, William B. Ray, M.D., 320 E. North Avenue, N. S. Pittsburgh; *Secretary,* Harold W. Jacox, M.D., 4800 Friendship Ave. Meetings held second Wednesday of each month at 4:30 P.M., from October to June at various hospitals designated by program committee.

RHODE ISLAND

See New England Roentgen Ray Society.

SOUTH CAROLINA

South Carolina X-ray Society.—President, Percy D. Hay, Jr., M.D., McLeod Infirmary, Florence; *Secretary-Treasurer,* Hillyer Rudisill, Jr., M.D., Roper Hospital, Charleston. Meetings in Charleston on first Thursday in November, also at time and place of South Carolina State Medical Association.

SOUTH DAKOTA

Meets with Minnesota Radiological Society.

TENNESSEE

Memphis Roentgen Club.—Chairmanship rotates monthly in alphabetical order. Meetings second Tuesday of each month at University Center.

Tennessee State Radiological Society.—President, S. S. Marchbanks, M.D., 508 Medical Arts Bldg., Chattanooga; *Vice-president,* Steve W. Coley, M.D., Methodist Hospital, Memphis; *Secretary-Treasurer,* Franklin B. Bogart, M.D., 311 Medical Arts Bldg., Chattanooga. Meeting annually with State Medical Society in April.

TEXAS

Texas Radiological Society.—President, Jerome H. Smith, M.D., San Antonio; *President-elect,* C. F. Crain, M.D., Corpus Christi; *First Vice-president,* M. H. Glover, M.D., Wichita Falls; *Second Vice-president,* G. D. Carlson, M.D., Dallas; *Secretary-Treasurer,* Henry C. Harrell, M.D., 517 Pine St., Texarkana. Meets annually. Temple is place of next meeting.

VERMONT

See New England Roentgen Ray Society.

VIRGINIA

Radiological Society of Virginia.—President, Fred M. Hodges, M.D., 100 W. Franklin St., Richmond; *Vice-president,* L. F. Magruder, M.D., Raleigh and College Aves., Norfolk; *Secretary,* V. W. Archer, M.D., University of Virginia Hospital, Charlottesville.

WASHINGTON

Washington State Radiological Society.—President, H. E. Nichols, M.D., Stimson Bldg., Seattle; *Secretary,* T. T. Dawson, M.D., Fourth and Pike Bldg., Seattle. Meetings fourth Monday of each month at College Club.

WISCONSIN

Milwaukee Roentgen Ray Society.—Secretary, H. W. Hefke, M.D., Milwaukee Hospital, Milwaukee. Meets monthly on first Friday.

Radiological Section of the Wisconsin State Medical Society.—Secretary, Russel F. Wilson, M.D., Beloit Municipal Hospital, Beloit. Two-day annual meeting in May and one day in connection with annual meeting of State Medical Society, in September.

University of Wisconsin Radiological Conference.—Secretary, E. A. Pohle, M.D., 1300 University Ave., Madison, Wis. Meets every Thursday from 4 to 5 P.M., Room 301, Service Memorial Institute.

EDITORIAL

LEON J. MENVILLE, M.D., *Editor* HOWARD P. DOUB, M.D., *Associate Editor*

PASSING ON THE PRESIDENCY[1]

It is the last honorable duty of my office as President of the Fourth International Congress of Radiology, to open the Fifth Congress in Chicago in 1937. To the United States of America, to the City of Chicago and to the organizers of the Congress, whose guests we are, I bring the greetings of radiologists throughout the whole world.

Congresses are milestones on the road to knowledge along which one stops occasionally to review one's progress, one's course, one's destination, and to meet one's fellow-travellers. The Congress at Zürich is long since a thing of the past and we have advanced the considerable distance to the next milestone at Chicago. I open the Fifth International Congress of Radiology, which is now meeting in the great Republic of the United States, with the wish that our international meetings, so rich in tradition, may bind all participants together in mutual respect and friendship. I hope that our efforts will best meet the needs and avail for the advantage of all sufferers. May this Congress fulfill our wishes for the progress of the science of radiology. These are the three wishes of your retiring President.

I declare hereby that the Fifth International Congress of Radiology is opened.

Only for a few minutes longer am I privileged to wear the beautiful golden chain with which I will shortly invest my successor, Doctor Christie. I have guarded it faithfully and am passing it on as a symbol of the solidarity by which the radiologists of the whole world are linked together. For the first time it is being transferred to another continent. It comes to you from a small country, the oldest republic in Europe, to the large and mighty Sister Republic of North America. Great is this country, gigantically great. Laved by two oceans, it stretches from the borders of the Dominion of Canada in the north to the highlands of Mexico in the south. This vastness has been impressed on me constantly since my arrival in your country. The speed of your development was also an enormous one and in a short time you have made as much progress as we in Europe have in hundreds of years. Your history begins the twelfth of October, 1492. A historical date for you is the memorable landing of the *Mayflower* on December 21, 1620. The sixteenth century was for you a period of the hunters, the pioneers, and the farmers. With remarkable zeal you have conquered your country and as talented colonists have created from nothing a people, a nation, and a country. It was about a hundred and fifty years after the discovery of America that the first university was established here, Harvard College in Massachusetts. This University is older, therefore, than the Universities of Berlin, of Göttingen, or of Zürich. But this first American college did not have any medical school. It was in Philadelphia that the first medical faculty was established in 1765. This same city, in 1732, had already established the first hospital on the North American continent, exclusively for the reception and medical treatment of patients. These foundations were definite proof that America had become mature, and that it was ready to take its place with Europe in the development of medicine as a science. A worldwide political conception has encouraged this tendency. In your Declaration of Independence of July 4, 1776, you have made it known to the world with clear, splendid, proud, and unequivocal words which, in my own country as in America, are the foundation of our very existence. The most important and greatest document of your country begins with the words: "We hold these truths to be self-evident: that all men

[1] Opening address, Fifth International Congress of Radiology, Sept. 13, 1937.

are created equal; that they are endowed by their Creator with certain inalienable rights; that among these are life, liberty, and the pursuit of happiness."

On this foundation you have steadily built your country in all realms of human activity. One must admit that at first the European influence was definitely noticeable in all branches of culture. In the early days the young student or physician was obliged to go to Europe from America to observe there and to learn there. But by the end of the eighteenth and the beginning of the nineteenth century many great citizens had returned to the United States with what they had received in Europe. Benjamin Franklin was imbued with the real scientific curiosity of research. Above all things, the application of pure science to daily life captivated him. Among other experiments, he attempted to make electricity useful in the treatment of paralysis.

I believe, moreover, that this practical sense, this pioneer spirit, still lives amongst you. There still remain wildernesses and prairies to conquer, but they lie in the spiritual field. The series of great discoverers since Benjamin Franklin has never been interrupted. Let me mention, from the chain of these great men, the inventor Edison. Even though he was not directly concerned with the field of medicine, he made important contributions to it nevertheless, and without Edison medicine might not have its present aspect. Amongst your physicians, even at the beginning of the nineteenth century, you had great scholars, who, almost independent of European thought, had made their discoveries far from universities and clinics. The practical surgeon, Ephraim McDowell, was busy in a field near the radiologic. He carried out the first oöphorectomy for the treatment of a tumor. Shortly Europe began to pay attention to him and to imitate him; to-day his operation is a common property of all surgery. The military surgeon, William Beaumont, worked in the wilderness far from laboratories and libraries, yet he made the first important researches and observations on gastric juices and the physiology of digestion. I might mention amongst the list of great scholars of the early days of America, Oliver Wendell Holmes, for he means to you what Semmelweis means to us in Europe. Holmes had brilliant and correct ideas about puerperal sepsis which he summed up in an undying essay. Few of us realize that the terms "anesthesia" and "anesthetic" came from him. With the introduction of ether narcosis by Crawford Williamson Long and by William Thomas Green Morton, America gave suffering humanity its first hope. It gave the surgeon a foundation on which all further surgical progress was based. Let us avoid naming other leaders. The further development in America followed the same general lines as it did in Europe. Medical instruction had to be developed. Laboratories had to be established and libraries had to be founded. In other words, scientific activity was organized and centralized. As the result of this progress it gradually became unnecessary for the American physician to journey to Europe for special training. He had in his own country everything necessary for progress in the clinical fields, for progress in instruction and research. Let two more names be mentioned: John Shaw Billings was a pioneer in medical book making and at the same time was the founder of medical statistics in America. And in William Osler you have a personality who was outstanding as a physician, as a teacher, and as a man. He became the Boerhaave of America.

And how are matters to-day? It has become necessary for us in Europe to come to you and to learn from you. We can no longer exist without American research. We admire your hospitals, your laboratories, and we are dependent on your discoveries. This recent development of medicine in America began for us with the opening of the medical school of Johns Hopkins University as a scientific center of the first class in the year 1893. A second milestone was the foundation of the Rockefeller Institute of Medical Research in the year 1901, and the third great step was the development of preventive medicine by the Rockefeller Foundation.

What have you accomplished by these institutions which seem to us Europeans uncomprehensibly large? Progress added to progress. Insulin came from America. Liver therapy of pernicious anemia is the result of your researches. Modern brain surgery originated in North America. Your great progress in bacteriology and serology is a thing of the immediate past. Let me mention typing the pneumococci; the discovery of carbohydrates as specific antigens; the modern virus researches; your wonderful methods of blood chemistry; your progress in the field of the ferments, the vitamins, and the hormones, and the synthesis and development of tissue cul-

tures, and your fundamental discoveries in the field of genetics. I might mention also the collaboration of the various American clinics; for example, in the Registry of Bone Sarcoma. In this assembly of radiologists it would be out of place for me to speak of the splendid work of American research workers in the field of radiology. This will be brought out at the scientific meetings.

In the last thirty years America has come to be the leader in research in the whole field of medicine. How is this possible? What is the reason for this unheard-of development? It is your idealism, that idealism which flourishes only under freedom. It is that idealism which has as the goal of all labor the benefit and welfare of mankind. It is your faith that he who is devoted to science serves all humanity. Science is not limited by political boundaries or political views. The scientific spirit knits people more closely together. Science needs collaboration of different nations with their different means and their different views, with their different methods and temperaments, that they may reciprocally complete it and nourish it. Science is the exact opposite to international narrowmindedness. Its ends cannot be achieved without divergence of opinion and without contrary criticism, because truth lies hidden and cannot be easily found and it is not recognized by all simultaneously. May this Congress in your free country and under the leadership of your great president be a step towards the desired goal. Each step of progress is the doorway to new problems. The beauty of science is that it never comes to an end.

These are the wishes and thoughts which move me in this moment, as I confer on you, highly honored Doctor Christie, the Presidency of the Fifth International Congress of Radiology. They find their expression in the bestowal on you of the insignia with which the office of the Presidency has been traditionally distinguished. It has become the custom that the retiring President in the name of his own country shall give to the new President a little present as a symbol of the passing of the last milestone of advance in radiologic progress. In the name of the Swiss radiologists I have brought with me a work of our goldsmiths which I am going to present to you and your successors. May this gift take its place in the honorable collection of treasures which have been bestowed on the former presidents. With the presidential chain, the splendid gift of the British Institute of Radiology, I shall place in your hands the honorable gavel as a sign of your power. The Swedes brought it to Paris and presented it as a commander's staff in the battle against disease and suffering. The other gavel, which came from the icebergs of Alaska, returns to its fatherland and is destined to be handed down through the centuries from president to president, after this ivory lay buried for a million years in the ice. It is a gift of the Fifth Radiological Congress in the United States of America. Added to it, in Zürich, was the artistic silver goblet which was presented by the French radiologists. On its base are engraved the undying names of Wilhelm Konrad Röntgen, Henry Becquerel, and Pierre and Marie Curie. At the concluding banquet this goblet will be handed from member to member as a symbol of our scientific thirst, and of our friendship. One thing more, the International Radiological Congress never has had until to-day, a seal. This seal I am bringing in remembrance of the Zürich Congress. It shows us there in the activity of our calling. Our media are the roentgen rays and radium. Our goal is the recognition of suffering and its healing. So you will see on the handle of the seal two physicians who are, with a fluoroscope, examining a patient, a nurse brings radium, and a third helper a roentgen tube. The seal itself shows a serpent winding around a shining sun. The sun heals, the serpent is a symbol of the physician, but the serpent is also the idealization of poison, of evil, and of cancer. At the same time, the serpent which is biting its own tail is the symbol of eternity. The symbol expresses the craft of healing, the battle with malignant disease, and the undying effort and labor to which we are dedicated. May this be the symbol of the international assemblage to which we belong. The white cross in the red field of the flag of my fatherland has suggested and occasioned the red cross in the white field, that standard of the salvatory international union of peoples which combats as we do the suffering of mankind. May the archives of international congresses of the future be decorated with this seal.

The chief mark of the Presidency is, and will continue to be, the golden chain. I will take it from my shoulders and place it around yours. By this act I have laid down my office and have taken my place amongst the host of participants in this Congress who, all with me, pay homage to the President of the Fifth Inter-

national Congress, and we wish that his country shall thrive and flourish for the welfare of all humanity.

It is the special right of universities to confer the doctorate. This honor is achieved by years of conscientious study. Only exceptionally is an honorary doctorate conferred. The University of Zürich is proud of the fact that it gave an honorary degree at the Third International Congress of Radiology in Paris to the dear Nestor of French radiology, Antoine Béclère. In the same way the University of Zürich honored at the Fourth International Congress of Radiology the leader of radiology in Europe, Gösta Forssell, and now I have the great pleasure of conferring an honorary doctor's degree from the Medical Faculty of Zürich on a citizen of the United States, citizen of America, whose inestimable service to the science of medical radiology is known to all.

In the name of the Rector of the University of Zürich and in the name of the Dean of the Medical Faculty of Zürich, and in the name of the Medical Faculty of Zürich, I confer on William D. Coolidge, your honorable Honorary Vice-president, the diploma of Doctor of Medicine *honoris causa*. The document reads:

The Medical Faculty of the University of Zürich, under the Rectorship of Herr Professor Oskar Bürgi, Doctor of Veterinary Medicine, and under the Deanship of Herr Professor Doctor of Medicine Wilhelm Löffler, confer on Dr. William D. Coolidge, of Rochester, N. Y., U. S. A., in recognition of his outstanding services in the field of physics as applied to medicine, particularly in the field of roentgen technic, the Honorary Degree of Doctor of Medicine. In witness hereof this document has been sealed with the University seal of the Faculty of Medicine.

Zürich, 4 July, 1937

Rector of the University,
O. BÜRGI.
Dean of the Medical Faculty,
W. LÖFFLER.

I know that the scientific world assembled here will, with me, heartily congratulate Doctor Coolidge on this honor and will be proud to recognize him as our youngest Honorary Doctor of Medicine. American radiology may at the same time regard this singling out of one of your citizens as our recognition and admiration of American research. In Zürich we are proud that we have conferred honorary degrees on two great American scholars, Thomas Hunt Morgan, the researcher in the field of genetics, and the talented physicist and scientist, William D. Coolidge. In this sense I take pleasure in conferring on you this diploma.

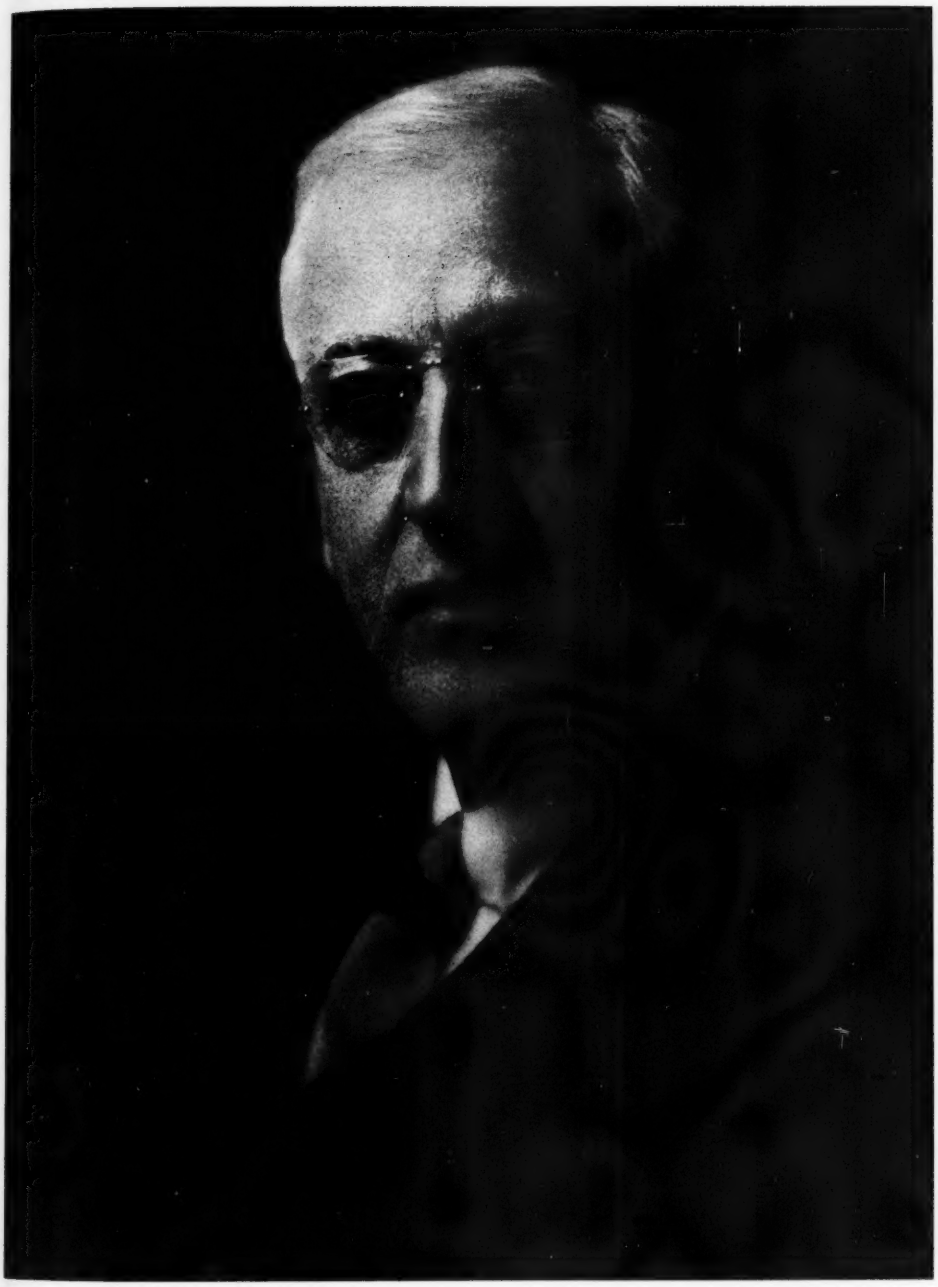
HANS R. SCHINZ, M.D.

RAYMOND GRISWOLD TAYLOR: AN APPRECIATION

It is generally accepted that there is no better foundation for specialization than a few years in general practice. Now that the second generation of radiologists is in full tide, this truism is perhaps more fully appreciated than at the time when Dr. Raymond Taylor started upon his career in radiology.

Born in Illinois in 1872, Dr. Taylor came to California with his parents in 1889, and graduated from the University of Southern California Department of Medicine in 1896. For three years he was connected with the Los Angeles General Hospital; then for seven years he was in general practice, and, for another ten, in surgery. He then took graduate work in radiology under George W. Holmes, M.D., at the Massachusetts General Hospital and, since 1918, has limited his practice to radiology. Dr. Raymond Taylor's career in radiology, therefore, bears the hallmark of a physician more than usually well versed in the practice of medicine prior to the adoption of his specialty.

Dr. Taylor joined the Radiological Society of North America in 1920, and has been a Vice-president of that organization on two occasions, first in 1926 and again in 1936. He has served on numerous committees of our Society, and has worked ardently for organized radiology, so that, in assuming the Presidency, he exemplifies Bacon's immortal remark, "Men in great place are thrice servants." In addition to his duties with the Radiological Society, he has found time to serve both as Secretary and President of the Los Angeles County Medical Society, to be Chief of Staff of the Good Samaritan Hospital, Chairman of the Section on Radiology of the California Medical Association,



Blackstone Western Studio, Hollywood, Calif.

RAYMOND GRISWOLD TAYLOR, M.D.
President of the Radiological Society of North America

Chairman of the Pacific Roentgen Club, and is now Chairman of the Section on Radiology of the American Medical Association. He has been a member of the American Roentgen Ray Society since 1922, a Fellow of the American College of Radiology since 1923, and a diplomate of the American Board of Radiology since its foundation.

Dr. Taylor's contributions to radiological literature are familiar to all who read our two national radiological journals. He has the distinction of having a son who is also a radiologist, a diplomate of the American Board of Radiology, and associated with his father in practice. Our Society may well count itself fortunate in having so able a physician at its helm, and may look forward to a year of progress under the guidance of one who will temper idealism with experience, and courage with wisdom.

L. H. GARLAND, M.D.

COMMUNICATIONS

ANNUAL MEETING HELD IN PITTSBURGH

The Twenty-fourth Annual Meeting of the Radiological Society of North America, held in Pittsburgh, Nov. 28–Dec. 2, 1938, was one of the finest in the history of the Society. The attendance was larger than usual—members coming from all parts of the United States and Canada and, in addition, a goodly number of non-member visitors from various places.

The Refresher Courses, an innovation introduced this year and under the guidance of Lewis G. Allen, M.D., of Kansas City, Kansas, proved to be a tremendous success. Several hundred members registered and the courses, which began the day before the meeting, were all well attended. In order that our absent members and the readers of our Journal may obtain information concerning the importance of the subjects presented and the names of the various participating physicists and radiologists of national fame, we are presenting herewith a brief outline of each course.

Physics of Radiation, directed by James L. Weatherwax, M.A., of the Philadelphia General Hospital, and Edith H. Quimby, M.A., of the Memorial Hospital of New York City, was the opening course. It presented in a comprehensive manner the characteristics of roentgen radiation: dosimetry, isodose curves, depth dose charts, definition of dosage, biological effect of irradiation, radiosensitivity, theories of radiation reaction, protective measures, and the typical roentgen and radium therapy technic and factors.

The second course, Radiology of the Chest, was ably conducted by Walter W. Wasson, M.D., of St. Anthony's Hospital, Denver, Colorado, and dealt with the anatomy of the lungs with corrosive specimens; anatomy of the lungs and thorax as portrayed by the roentgen film; physiology of the lungs and mechanics of the thorax as they pertain to roentgenology; diseases of the chest with a discussion of their classification, portrayal and diagnosis, and the radiation therapy of the thorax and a discussion of its hazards.

The course on Radiology of the Gastro-intestinal Tract, under the direction of Eugene P. Pendergrass, M.D., of the University of Pennsylvania, assisted by William O. Abbott, M.D., J. Gershon-Cohen, M.D., and I. S. Ravdin, M.D., of Philadelphia, was a six-hour discussion. The first half was divided equally between a discussion of the physiology of the gastro-intestinal tract by Dr. Abbott, and the roentgen examination of the esophagus, stomach, and small intestine by Dr. Pendergrass. The last half consisted of three discussions, namely, roentgenology of the colon by Dr. Gershon-Cohen, physiology of the gall bladder by Dr. Ravdin, and the roentgenologic aspect of the gall bladder by Dr. Pendergrass.

W. Carpenter MacCarty, M.D., of the Mayo Clinic, gave a lengthy and exhaustive course on the Pathology of Tumors. This course was divided into morning and afternoon sessions. The first part consisted of a brief historical sketch of the evolution of pathology, pathologists, and radiologists and the relation of each to clinical medicine; fundamentals underlying disease, and the fundamentals of the evolution of neoplastic conditions, especially in their relation to x-ray diagnosis and radiological treatment. The afternoon session had to do with the language of disease; clinical and radiological classification of inflammatory and neoplastic diseases, and practical bio-pathologic, physical, and radiological classifications of disease. Additional topics were the difficulties of the Examining Board and subjects for review.

The Radiology of Bone Tumors, an especially interesting course, was conducted by J. T. Murphy, M.D., of St. Vincent's Hospital,

Annual Banquet
of the
Radiological Society of North America
Hotel Am Penn
Dec 1948

Toledo, Ohio, as a clinical-pathological conference with Plinn F. Morse, M.D., of Toledo. Differential diagnosis and treatment were emphasized; the field of bone tumors was tersely classified, and illustrated examples of each class were presented.

The course on Roentgen Analysis of Fractures by W. Edward Chamberlain, M.D., of Temple University, Philadelphia, was presented systematically with the employment of apparatus to illustrate certain features. Fluoroscopic methods were demonstrated and many helpful and ingenious plans for the analysis and handling of fracture problems were shown.

The presentation of Radiology of Sinuses and Mastoids, by George W. Grier, M.D., of the University of Pittsburgh, was the last course, and covered the subject thoroughly in regard to anatomy, production of radiographs, pathology of disease, roentgen interpretation, and radiation therapy.

As always, the Clinics, which were held every afternoon except Friday, were well attended and offered much worth-while material.

The Scientific Sessions were held daily throughout the Meeting. The program showed very careful and thoughtful consideration and planning, and the papers presented by the most eminent and experienced men in our field covered practically all subjects of science, diagnosis, and therapy. The papers presented will be published in the Journal during the coming year.

Several separate rooms were devoted to the Scientific Exhibits, which numbered 39 and were uncommonly interesting and diversified.

The following is an extract from the minutes of the Society pertaining to the scientific awards:

"The officers and members of the Radiological Society of North America are very appreciative of the scientific exhibits. These exhibits have added a great deal to the educational value of this Meeting and have been of an unusually high quality. It is recognized that they have been prepared and shown at no small effort and expense by the exhibitors.

"These exhibits have been graded according to their scientific value, the originality of investigation, and as to their excellence of presentation.

"The first award is given to 'Body Section Radiography with the Laminagraph,' by Sherwood Moore, M.D., St. Louis, Missouri.

"The second award goes for 'The Use of the Mobile X-ray Unit in Treatment of Peritonitis, Gas Gangrene, and Other Inflammatory Processes, at the Bedside,' by James F. Kelly, M.D., and D. Arnold Dowell, M.D., Omaha, Nebraska.

"The third award goes for 'Intestinal Intubation in the Treatment and Localization of Acute Intestinal Obstruction and Paralytic Ileus,' by Doctors C. G. Johnston, G. C. Penberthy, R. J. Noer, J. C. Kenning, and J. E. Lofstrom, of Detroit, Michigan.

"The following exhibits are given Honorable Mention:

"First, 'Intraspinal Protrusion of the Intervertebral Disks,' by Doctors John D. Camp, Maurice Walsh, and J. G. Love, of the Mayo Clinic, Rochester, Minnesota.

"Second, 'Air Myelography,' by Doctors W. Edward Chamberlain and Barton R. Young, of Philadelphia, Pennsylvania.

"Third, 'The Roentgenologic Diagnosis of Strawberry Gall Bladder,' by Doctors George Levene, Robert M. Lowman, and Egon G. Wissing, of Massachusetts Memorial Hospital, Boston, Massachusetts.

"Fourth, 'Carcinoma of the Breast,' by Eugene R. Whitmore, M.D., Washington, D. C.

"Fifth, 'Late Sequelæ of Biologic Effects Produced by Irradiation,' by T. Leucutia, M.D., and Eldwin R. Witwer, M.D., of Detroit, Michigan."

Twenty-three companies were represented in the Commercial Exhibits. Numerous advances in type and style of apparatus were shown and those attending enjoyed and profited from the demonstrations by the factory representatives.

Carman Night, a high-light of every Meeting, was presided over by the President, Howard P. Doub, M.D. The lecturer was William Carpenter MacCarty, Sr., M.D., of the Mayo Clinic, who chose for his subject, Cancer of the Stomach. The address was splendidly delivered and showed much research, study, and experience. Dr. MacCarty was awarded the Society's Honorary Fellowship.

The social program afforded a pleasant interlude and was adequately filled by the informal Stag Night, enjoyed by a large number; the banquet, which was exceptionally well handled, and during which the incoming officers were introduced; and the ladies' entertainment, consisting of several sight-seeing trips over the city, luncheons, and teas.

To Zoe Allison Johnston, M.D., Chairman of the General Arrangements Committee, to

the Pittsburgh Roentgen Society and the Allegheny County Medical Society, and to all who served on committees, much credit is due for the success of the Meeting and the comfort and pleasure of those attending.

AUTHORS' NOTE ON "EXCRETORY UROGRAPHY BY THE INTRAMUSCULAR INJECTION OF DIODRAST"

Clinical experience causes us to condemn the *subcutaneous* injection of undiluted diodrast. Absorption is slower and irritation is definitely greater following subcutaneous injection than following intramuscular injection. Our recent article, "Excretory Urography by the Intramuscular Injection of Diodrast," RADIOLOGY, **31,** 587–594, November, 1938, quotes findings in certain animal experiments done elsewhere as permitting the subcutaneous administration of 35 per cent diodrast. These findings appear unreliable on analysis and the clinical interpretation is therefore unwarranted. Sloughing of tissues in the antecubital fossa has been reported following the subcutaneous extravasation of undiluted diodrast during attempted intravenous injection. Subcutaneous injection of 10 per cent diodrast is a safe procedure.

On the basis of our clinical experience we do believe that the intramuscular administration of 15 to 35 per cent diodrast is a safe and satisfactory procedure in case intravenous injection is impractical.

HOWARD B. HUNT, M.D.
ALFRED M. POPMA, M.D.

FLORIDA RADIOLOGICAL SOCIETY

The Fall meeting of the Florida Radiological Society was held at the San Juan Hotel, Orlando, Florida, November 12 and 13. The sessions were devoted to presentation of interesting case histories illustrated by films and lantern slides. There was free discussion of therapeutic problems affecting radiology.

The names of the officers will be found on page 102 of this issue.

ANNOUNCEMENTS

THE AMERICAN BOARD OF RADIOLOGY

As announced in the December issue of RADIOLOGY, the next examination to be conducted by The American Board of Radiology will be in St. Louis, May 11 to 14, 1939. The Jefferson Hotel has been selected as the radiologic headquarters. The following organizations will have headquarters in that hotel: American Board of Radiology, American Radium Society, Inter-Society Committee for Radiology, American College of Radiology, and the Section on Radiology of the American Medical Association. Reservations will be at a premium and the sooner one writes, the more sure one will be of accommodations.

Those contemplating appearing for examination at that time should file their applications with the Secretary-Treasurer, B. R. Kirklin, M.D., Mayo Clinic, Rochester, Minn., by Feb. 1, 1939, if possible.

FOURTH ANNUAL POST-GRADUATE INSTITUTE

The Philadelphia County Medical Society desires to announce formally, the completion of its scientific program for the Fourth Annual Post-graduate Institute to be held in the Bellevue-Stratford Hotel, Philadelphia, during the week beginning March 13, 1939. The subjects to be considered are those embraced by the terms blood dyscrasias and metabolic disorders. These will be further subdivided for convenience in instruction into 86 clinical lectures, with open forum discussion for each topic, delivered by as many individual specialists of national distinction.

The preëminent position of Philadelphia as a medical center in the past has been justified by its large array of first-class hospitals and contributory institutions, and that conservative scholastic atmosphere so essential to careful and dependable research. Despite the development of medical centers in other areas, Philadelphia has continued to maintain its enviable position and it has been the desire of the Philadelphia County Medical Society to release to its own members and to those of the medical profession in general, the results of the labors so diligently conducted within the walls of the city's several medical schools.

The tremendous advances in the medical

sciences since the World War have increased the demands of the lay public for medical information. The development of the channels for communication have familiarized the public with medical conditions and terms to such an extent that the physician must keep himself at least informed if not intensely educated concerning the most recent work in the medical field. He cannot conduct his practice along the older lines without continuing his education in the new.

The Post-graduate Institute aims to fill this need and the participants may be assured that they will unquestionably profit by the program to be presented.

Address all inquiries to the Philadelphia County Medical Society, Twenty-first and Spruce Streets, Philadelphia.

CANADIAN ASSOCIATION OF RADIOLOGISTS

The Canadian Association of Radiologists, an organization comprising over 90 per cent of full-time radiologists in the Dominion of Canada, was established in December, 1936, with the object of promoting the interests of radiology in relation to medicine with particular reference to clinical, educational, ethical, and economical phases.

Membership in the Canadian Association of Radiologists is limited to graduates in medicine who have been doing radiology full-time for at least five years. Membership-elect is provided for those men who are now training in radiology who have had less than five years' experience. Men starting training in radiology after the first of January, 1938, are required to possess a recognized diploma in radiology or to pass examinations set by the Association for membership. The Association, therefore, becomes the qualifying body for radiologists in Canada.

The constitution of the Association is based largely upon the constitution of the British Association of Radiologists and the requirements for membership are such as to correspond with the requirements of the British Association of Radiologists and with the American Board of Radiology.

The officers are as follows: W. A. Jones, M.D., of Kingston, *President;* J. E. Gendreau, M.D., of Montreal, *Vice-president* and A. C. Singleton, M.D., 170 St. George Street, Toronto, *Hon. Secretary-Treasurer.*

BOOK REVIEW

MALIGNANT TUMORS OF THE SKELETAL MUSCLES, FASCIÆ, JOINT CAPSULES, TENDON SHEATHS, AND SEROUS BURSÆ. By GUNNAR JÖNSSON. Acta Radiologica, Suppl. XXXVI. A volume of 304 pages. Published by P. A. Norstedt & Soner, Stockholm, 1938. Price: 20 Swed. cr.

This publication, a monograph in English published as a supplement of the *Acta Radiologica*, is an excellent summary of our knowledge to date of this important subject. The work is based on a study of the material in the Radiumhemmet and includes a very careful review of this material. Beside this, the author has given a complete and excellent summary of the literature, bringing it down from the earliest recognition of the work to our present times.

Chapters then go on to discuss the material, the frequency, age and sex distribution, early symptoms, gross appearance, and several other important phases of our knowledge on this subject.

The classification used is, according to the author, "based on a comparative clinical and pathologico-anatomic investigation of the material." He states that "American workers have attacked the old, morphologic classification of these tumors and stressed its unsuitability for clinical use. According to them, we must concentrate on attaining a histogenetic basis for our grouping."

Several excellent photomicrographs illustrating the various types are presented and a complete presentation of all the reports of the 112 cases recorded is given.

As a result of his experience, the author shows that rhabdomyosarcomas are but slightly radiosensitive. The spindle-cell sarcomas generally show a moderate, but fibrosarcomas a very low, degree of radiosensitivity. Myxoliposarcomas do not seem to respond very much to radiation. The sensitivity of round-cell sarcomas cannot be judged from the Radiumhemmet's material. Synovialomas are sometimes so radiosensitive that they can be made to disappear with radiologic treatment only. Synovial fibrosarcomas show but very little response.

ABSTRACTS OF CURRENT LITERATURE

CONTENTS BY SUBJECT

The Intestines ... 117
Leukemia ... 118
The Lungs ... 119
Otitis Media ... 120
Pelvic Measurements ... 120
Peptic Ulcer ... 120
Perirenal Insufflation ... 121
Pitressin ... 122
Radiation ... 122
Radium ... 122
Roentgenography, Technic ... 123
Seminal Vesicles ... 124
The Spine ... 124
The Stomach ... 125
The Thymus ... 126
Tuberculosis, Pulmonary ... 126
Tuberculosis, Renal ... 128
Tumors (Diagnosis) ... 128
Ultra-violet Light ... 130
Venography ... 130

THE FOLLOWING ABSTRACTORS HAVE CONTRIBUTED TO THIS ISSUE

S. Richard Beatty, M.D., of Denver, Colo.
James J. Clark, M.D., of Atlanta, Ga.
Max Climan, M.D., of Hartford, Conn.
M. L. Connelly, M.D., of Chicago, Ill.
Q. B. Coray, M.D., of Salt Lake City, Utah
Irving I. Cowan, M.D., of Milwaukee, Wis.
William H. Gillentine, M.D., of New Orleans, La.
Lewis G. Jacobs, M.D., of Winona, Minn.
John B. McAneny, M.D., of Madison, Wis.
Antonio Mayoral, M.D., of New Orleans, La.
John G. Menville, M.D., of New Orleans, La.
John M. Miles, M.D., of Lafayette, La.
Ernst A. Pohle, M.D., Ph.D., of Madison, Wis.
Simon Pollack, M.D., of Chicago, Ill.
Jacob Sagel, M.D., of Gary, Ind.
Ernst A. Schmidt, M.D., of Denver, Colo.
Charles G. Sutherland, M.D., of Rochester, Minn.

ABSTRACTS IN THIS ISSUE LISTED ALPHABETICALLY BY AUTHORS

Andersson, Olof. Venography in a Case of So-called Traumatic Thrombosis of the Axillary Vein ... 130
Bailey, Wilbur, and Carter, Ray A. Anomalies of the Spine ... 125
Bensaude, Alfred, and Bertillon, F. Hemorrhoids and Ano-rectal Angiomas in Infants ... 123
Berg, Albert A., *with* Crohn, Burrill B., jt. auth. ... 117
Bergendal, Asta. A Review of 20 Years' Radium Treatment of Lip Cancer at the Radiological Clinic, Lund, Sweden ... 123
Bertillon, F., *with* Bensaude, Alfred, jt. auth. 123
Betlach, C. J. The Effects of Pentothal Sodium on the Electrocardiogram of Patients with Essential Hypertension ... 128
Betoulieres, Pierre, *with* Terracol, J., jt. auth. ... 121
Biancani, E., and Biancani, H. Ultra-violet Therapy: Several New Sources of Radiation, Their Mechanism of Action and Clinical Indications ... 130
Biancani, H., *with* Biancani, E., jt. auth. ... 130
Borland, James L., *with* Gaither, Ernest H., jt. auth. ... 126
Braasch, William F., *with* Emmett, John L., jt. auth. ... 128
Breton, A., *with* Pierret, jt. auth. ... 119
Carter, Ray A., *with* Bailey, Wilbur, jt. auth. 125
Cavarozzi, Nicola. Relative Insufficiency of the Pulmonary in Fibrothorax ... 119
Charr, Robert, and Cohen, Archibald C. Tuberculosis of Intestines in Tuberculous Anthracosilicosis ... 126
Chêne, P., and Ramadout, M. Volvulus of the Stomach ... 125
Cohen, Archibald C., *with* Charr, Robert, jt. auth. ... 126
Coulouma, P., *with* Pierret, jt. auth. ... 119
Christopher, Frederick. Intestinal Obstruction ... 117
Crohn, Burrill B., and Berg, Albert A. Right-sided (Regional) Colitis ... 117
Croizat, P., *with* Froment, J., jt. auth. ... 125
Devos, L., *with* Pierret, jt. auth. ... 119
Donaldson, S. W. A Study of the Relations between Birth Weight and Size of the Thymus Shadow in 2,000 New-born ... 126
Emmett, John L., and Braasch, William F. Has Excretory Urography Replaced Retrograde Pyelography in the Diagnosis of Renal Tuberculosis? ... 128
Farrell, Malcolm J. The Use of Prostigmin as a Preparation for Abdominal Roentgenography ... 123
Feid, Louis, Jr. Use of Radium in the Treatment of Uterine Fibroids ... 122
Finocchiaro, José, *with* Neto, Alipio Correia, jt. auth. ... 119
Fleming, Bruce L. Cystic Hygroma of the Neck ... 129
Froment, J., Croizat, P., and Masson, R. Radiculo-medullary Compression in the Course of Malignant Granulomatosis ... 125
Gaither, Ernest H., and Borland, James L. Gastroscopic Studies ... 126
Girard, M., *with* Savy, P., jt. auth. ... 121
Graf, J., *with* Graf, L., jt. auth. ... 122
Graf, L., and Graf, J. The Problem of Potential in Deep Therapy ... 122
Grigsby, Guy P., and Kaplan, Sidney E. Intussusception in Infancy and Childhood ... 117
Grossmann, G. The Spectral Distribution of a Heterogeneous Beam of Roentgen Rays ... 122
Hadley, Lee A. Pathologic Conditions of the Spine: Painful Disturbances of the Intervertebral Foramina ... 124
Hall, M. R. Roentgenological Diagnosis of Volvulus of Sigmoid Megacolon, with Report of Two Cases ... 117
Hayden, Charles Thomas. Roentgen-ray Pelvimetry ... 120

HENDERSON, W. R. The Anterior Basal Meningiomas 128
JAFFÉ, RICHARD H., *with* PORTIS, SIDNEY A., jt. auth. 120
JESSEL, GEORGE. Skiagraphy of the Chest 119
JONES, W. A. Points of Mutual Interest to the General Practitioner and the Radiologist 122
KAPLAN, SIDNEY E., *with* GRIGSBY, GUY P., jt. auth. 117
KHAYAT, Z., *with* SAVY, P., jt. auth. 121
KHOO, F. Y. Calcification in Angiomas 128
LACKEY, ROBERT W., *with* METZ, M. HILL, jt. auth. 120
LAMARQUE, P., *with* TERRACOL, J., jt. auth. 121
LEAVELL, BYRD S. Chronic Leukemia: A Study of the Incidence and Factors Influencing the Duration of Life 118
LEVINA, R. I. The Influence of Pituitrin on the Evacuation of the Stomach 126
MASSON, R., *with* FROMENT, J., jt. auth. 125
MAXWELL, J. H. The Management of the Septic Patient with Otitis Media 120
MENCHER, WILLIAM H. Perirenal Insufflation 121
METZ, M. HILL. A Gastric Lesion Produced by Posterior Pituitary Extract 125
METZ, M. HILL, and LACKEY, ROBERT W. Peptic Ulcer Treated by Posterior Pituitary Extract 120
MIALARET, J., *with* ROUX, JEAN-CHARLES, jt. auth. 117
NETO, ALIPIO CORREIA, and FINOCCHIARO, JOSÉ. Typhoid Empyema: Report of a Case Operated upon and Cured 119
NICHOLS, B. H. Acute Intestinal Obstruction 118
ORLEY, A. X-ray Pelvimetry 120
OVERGAARD, KRISTIAN. Schmorl's Cartilage Islands 125
PETERSON, ANDREW P. Retrograde Catheterization in Diagnosis and Treatment of Seminal Vesiculitis 124
PICARD, M. The Necessity of Systematic Use of Barium Enemas to Disclose Latent Intestinal Tuberculosis in Cases with Pulmonary Tuberculosis 128
PIERRET, COULOUMA, P., BRETON, A., and DEVOS, L. A New Conception of the Anatomical Structure of the Lungs: The Pulmonary Zones: Clinical and Radiologic Application. 119
POMEROY, LAWRENCE A. A Classification of Tumors 129
PORTIS, SIDNEY A., and JAFFÉ, RICHARD H. A Study of Peptic Ulcer Based on Necropsy Records 120
RAMADOUT, M., *with* CHÊNE, P., jt. auth. 125
RENANDER, AXEL. Roentgenological Changes in the Lungs Caused by Acetylene Gas 119
ROUX, JEAN-CHARLES, and MIALARET, J. Stenoses and False Stenoses of the Intestine in the Course of Grave Anemias 117
SABBIONE, CARLO. Radiological Study of Spontaneous Rib Fracture among the Tuberculous 127
SAVY, P., GIRARD, M., and KHAYAT, Z. Multiple Ulcers of the Stomach and Duodenum 121
SCHROEDER, HERMANN. The Effect of Ultraviolet Rays on the Vitamin C Content of Milk 130
SMEREKER, H., *with* WASSERBURGER, K., jt. auth. 122
SMYRNIOTIS, P. C. Several Cases of Radiography after the Injection of Pitressin: Experimental Proofs 122
STENSTRÖM, BO. Tumors of the Upper Pole of the Stomach 129
TERRACOL, J., LAMARQUE, P., and BETOULIERES, PIERRE. Peptic Ulcer of the Esophagus 121
TURNER, PHILIP. Acute Infective Osteomyelitis of the Spine 124
TYSON, RALPH M. Certain Significant Aspects of Childhood Tuberculosis 127
WASSERBURGER, K., and SMEREKER, H. Radium Therapy of Carcinoma of the Cervix 122
WEGELIUS, CARL. The Differences between Radiological and Anatomical Measurements 123
ZACHRISSON, CARL-GUSTAV. A Comparative Study of Radiograms and Anatomical Sections of the Temporal Bone 123

THE INTESTINES

Roentgenological Diagnosis of Volvulus of Sigmoid Megacolon, with Report of Two Cases. M. R. Hall. Am. Jour. Roentgenol. and Rad. Ther., **39,** 925–927, June, 1938.

Of 69 cases of volvulus of the sigmoid megacolon found in the literature, in only four patients was a diagnosis of volvulus made by means of the roentgen examination. Two detailed case reports are given and the author states that the roentgen diagnosis depends on: (1) tremendously dilated sigmoid in the right abdomen; (2) valve-like obstruction distal to the dilatation; (3) normal mucosal pattern in sigmoid and rectum distal to dilated loop.

IRVING I. COWAN, M.D.

Stenoses and False Stenoses of the Intestine in the Course of Grave Anemias. Jean-Charles Roux and J. Mialaret. Arch. d. mal. de l'app. digestif, **27,** 1062–1068, December, 1937.

True stenoses of the small intestine have been described in certain cases of grave anemias (pernicious). It must be remembered that false appearances of stenosis are also found in these anemias and that the response to treatment should be observed before laparotomy.

S. R. BEATTY, M.D.

Intussusception in Infancy and Childhood. Guy P. Grigsby and Sidney E. Kaplan. Kentucky Med., **36,** 318–323, August, 1938.

The authors make a very extensive study of intussusception in childhood and call to mind the fact that the condition causes about 75 per cent of all cases of intestinal obstruction in individuals up to the age of 12, and that it can and does occur in any portion of the large or small intestine.

Of special interest to the roentgenologist is the following paragraph: "It is agreed that the use of x-ray in acute cases is unnecessary. A barium enema was given in one of these cases, showing a hazy shadow, interpreted as an 'almost complete' obstruction in the ascending colon. In the few hours that elapsed between the x-ray film and the operation in this particular case, the intussusception had advanced to the splenic flexure."

A. MAYORAL, M.D.

Right-sided (Regional) Colitis. Burrill B. Crohn and Albert A. Berg. Jour. Am. Med. Assn., **110,** 32–37, Jan. 1, 1938.

This is a term early used by Bargen and recognized in the writings of members of the Mayo Clinic staff. The disease is essentially one of youth, affects members of both sexes, although it predominates in the male. The age incidence at the onset of symptoms averaged 23.4 years (8 to 44): nearly all the patients are between the ages of 20 and 30. The disease acts as if it were an infection, beginning with fever and prostration and spreading with, and against, the intestinal current like a low-grade infection.

There is a diffuse surface ulceration of the mucosa, suppurative involvement of the submucosa, thickening and induration of all the walls of the intestine, with chronic infiltration and scarring of the peritoneal serosa. The ulcers may be superficial but are more usually deep with thickening edges, and often coalesce to denude large areas of mucosa. In the late stage, polypoid hyperplasia is very common. Perforation or stricture was not observed in the authors' series.

The segments initially involved are most often the cecum and the ascending colon; in this form the terminal ileum is almost invariably included in the pathologic process.

Regional or right-sided colitis is not difficult to recognize either clinically or roentgenographically. Medical therapy offers little but a progressively downward course, while surgery offers a permanent cure, though not without risk.

CHARLES G. SUTHERLAND, M.D.

Intestinal Obstruction. Frederick Christopher. Jour. Okla. St. Med. Assn., **30,** 431–437, December, 1937.

The seriousness of intestinal obstruction is due to mechanical rather than toxic factors. As long as the bowel is viable absorption of toxic products does not occur.

The intra-enteric pressure in cases of human intestinal obstruction is from 4 to 14 cm. of water in the small, and from 12 to 52 cm. in the large bowel. Sustained intra-enteric pressure causes patches of necrosis and peritonitis. In animals, pressure of 40 cm. caused necrosis in 11 hours.

Loss of fluids, loss of mineral salts, and loss of blood are important considerations. Blood loss results from occlusion of the veins of the bowel. Experimentally, if the veins to a segment of bowel from three to four feet long are tied, enough blood is lost in from four to five hours to cause shock and death. However, in mesenteric thrombosis or embolism the symptoms often take a week to become severe.

Early diagnosis is important. X-ray examination should be made. Barium by mouth should not be given and barium enema is useless. A "scout" film is made supine, followed by radiographs made in the vertical and in the lateral horizontal positions. After a person is three years of age gas is normally absent from the small intestine. A vertical film of an inverted newborn distinguishes an imperforate anus from rectal atresia since the bubble of gas in the infant's colon seeks the highest level.

Chronic attacks of colic with visible peristalsis and loss of weight are usually the result of acquired strictures. Rebound tenderness and sensitive peritoneum mean strangulation. Blood in the stool suggests carcinoma.

In high obstruction after 48 hours there is a decrease in blood chlorides, and an increase in the CO_2 combining power and in the non-protein nitrogen of the blood. Leukocytosis is present late.

Treatment includes fluid replacement sufficient for a daily output of from 700 to 1,500 c.c. urine, blood transfusions, relief of gaseous distention through suction applied to a duodenal tube. Operation may or may not be necessary. Ether, ethylene, and cyclopropane are advised as anesthetics.

Operation may be for release of the bowel, inversion of gangrenous patches, resection, or enterostomy. The affected bowel should be observed 20 minutes for viability and return of function. Some strangulation recovers as late as ten hours and some fails to recover after only three hours. Enterostomy is useless in cases of tremendous distention and in paralytic ileus.

From 100 to 200 c.c. amniotic fluid concentrate is left in the abdomen if raw areas are left to guard against adhesions. Post-operatively from 3,000 to 4,000 c.c. fluid is given daily including one liter of physiologic saline. External application of heat probably increases peristalsis.

JOHN M. MILES, M.D.

Acute Intestinal Obstruction. B. H. Nichols. Ohio St. Med. Jour., **34,** 884–886, August, 1938.

The author presents a typical case history of small intestinal mechanical obstruction, the diagnosis by roentgenologic study of the abdomen, surgical proof and cure, and recovery. In his discussion he classifies obstruction into four main groups.

(1) Simple obstruction in which there is a mechanical interference with the passage of contents through the bowel. This is rapidly followed by accumulation of gas and metabolites proximally, and emesis and dehydration are rapid sequelæ. Death is not due to toxemia but to starvation, dehydration, and depletion of body chlorides.

(2) Obstruction with strangulation is a more complicated type in which the blood supply to an area of involved bowel is compromised. The common causes are strangulated hernia, volvulus, or intussusception, and the lethal factor is toxemic.

(3) High obstruction is a clinical variety in which the obstructive level is duodenal or high in the jejunum. This separate classification is advisable because of the marked disturbance of physiologic balance due to the fact that the upper gastro-intestinal secretions are expelled *via* reverse peristalsis and a relaxed pyloric sphincter and are not resorbed distally through the small bowel. Hence with the more rapid dehydration and chloride loss, the symptoms of toxemia and death come much sooner.

(4) Low obstruction is the well known clinical type involving the large bowel.

Adynamic ileus, the paralytic distention of the bowel seen in diffuse peritonitis, is to be differentiated from the mechanical types. The most important differential point clinically is the absence of auscultatory sounds in the abdomen in paralytic ileus. The obstipation, bowel distention, persistent vomiting, and dehydration may all be present and confusing.

In the roentgen study the suggested technic includes study of the abdomen in the horizontal and vertical positions. Distended loops of gas-filled bowel often present the diagnostic problem of differentiation between loops of colon or distended jejunum. However, the haustra of the colon show V-shaped indentations of the outer wall, whereas, the jejunal valvulæ conniventes usually show the indentations more distinctly on the inner wall. Barium, orally, is contra-indicated, as it does not help in the diagnosis and adds to the difficulty of subsequent surgery. In low obstructions barium enemas may be very helpful in localizing the level of the lesion.

Roentgen examination is of paramount importance in the diagnosis of the character and location of the intestinal obstruction.

SIMON POLLACK, M.D.

LEUKEMIA

Chronic Leukemia: A Study of the Incidence, and Factors Influencing the Duration of Life. Byrd S. Leavell. Am. Jour. Med. Sci., **196,** 329–340, September, 1938.

The cases of chronic leukemia admitted to several large general hospitals were studied with regard to the influence on duration of life, of age, anemia, leukocyte count, bleeding and specific skin lesions, as noted at the first admission of the patient.

As determined clinically, there was an appreciable increase in the incidence of leukemia from the period of 1915–1924 to that of 1925–1934. The incidence as noted at autopsy showed an increase varying from 60 per cent to 100 per cent over the 1905 to 1915 period, in each hospital. Because of different methods of computing admissions, figures for different hospitals cannot be compared, and the significance of the increases is uncertain.

The greatest number of cases of chronic myelogenous leukemia occurred between the ages of 35 and 45, and those of chronic lymphogenous leukemia between 45 and 55. Of the first group, 60 per cent, and of the second group, about 75 per cent were males.

The average duration of life after the onset of symptoms was 3.2 years in patients with chronic myelogenous leukemia, and 3.6 years in chronic lymphogenous leukemia. In the latter variety, the average survival was longer in those individuals who were between 40 and 60 years of age at the onset.

The cases with marked anemia, especially those of lymphogenous leukemia, ran a much shorter course than the others. The cases of the myelogenous variety with a leukocyte count of less than 40,000 per c. mm. had a much shorter course than those with a higher count. A relatively low leukocyte count was a more reliable sign of an early fatal outcome than a high count was of a more favorable outlook.

Bleeding, one of the commonest manifestations of leukemia, occurred most frequently in advanced and acute cases, and was a sign of an early termination. Some form of bleeding was shown at first admission by 20 per cent of the chronic myelogenous, and 16 per cent of the lymphogenous leukemias. Some patients with chronic myelogenous leukemia who show bleeding may do well under treatment, but this is less likely to occur if a marked anemia is present, and still less likely if the leukocyte count is low. The presence of leukemic skin lesions does not alter the prognosis.

BENJAMIN COPLEMAN, M.D.

THE LUNGS

Relative Insufficiency of the Pulmonary in Fibrothorax. Nicola Cavarozzi. Riv. di Pat. e Clin. d. Tuberc., **12,** 336–342, May, 1938.

The author mentions his previous publications in "Sanatorium," 1937, and reports two new cases in which extensive atelectasis of the right lung is accompanied by relative insufficiency of the pulmonary. The two cases reported are suffering from pulmonary tuberculosis and both show extensive fibrosis and atelectasis of the right lung with marked displacement of the mediastinum to the right. He believes that the hypertension and stasis caused in the lesser circulation by pleno-pulmonary fibrosis and atelectasis are responsible for the relative insufficiency of the pulmonary valve.

A. MAYORAL, M.D.

A New Conception of the Anatomical Structure of the Lungs: The Pulmonary Zones: Clinical and Radiologic Application. Pierret, P. Coulouma, A. Breton, and L. Devos. Bruxelles-méd., **18,** 1080–1083, June 19, 1938.

Anatomical and clinical studies show that the lungs are not made up primarily of asymmetrical lobes, but of seven symmetrical principal zones representing independent broncho-nervo-vascular segments separated by thin walls of connective tissue. This conception explains the triangular lesions frequently seen on the screen and film, for these partitions are as effective as the definite fissures, in limiting the spread of disease.

The zones are pyramidal, with the apices at the hila and the bases at the pleural surfaces of the lungs. They are designated as the apical, the superior, middle, and inferior dorsal zones, and the superior, middle, and inferior ventral zones. The major divisions of the bronchi and vessels supply the corresponding zones.

S. R. BEATTY, M.D.

Skiagraphy of the Chest. George Jessel. British Med. Jour., 276–279, Aug. 6, 1938.

The author introduces his article with the statement that the use of skiagrams may be regarded as the greatest advance in medicine during the past century and that skiagraphy of the chest has become an indispensable adjunct in diagnosis. Inspection, percussion, palpation, and auscultation are not displaced but reinforced by skiagraphs.

Tuberculosis should be suspected and skiagraphs made in the following circumstances: (1) cases of bronchial catarrh which do not clear up in four weeks; (2) patients complaining of indigestion and dyspepsia which may be manifestations of tuberculous toxemia; (3) alleged hemoptysis; (4) young persons with anemia and debility; (5) chronic hoarseness; (6) ischio-rectal abscess; (7) clearly tuberculous family history; (8) definite tuberculous associates, and (9) history of tuberculous meningitis or other non-pulmonary tuberculosis in the family.

Accurate differential diagnosis is essential and requires special skill and experience. Account is given of the routine of a tuberculosis clinic in the Lancashire area of which the author is an officer. It is apparent that a large amount of tuberculosis exists in this region. The population of 357,000 is serviced by five tuberculosis dispensaries. During 1937, 1,339 chest plates were made.

Q. B. CORAY, M.D.

Roentgenological Changes in the Lungs Caused by Acetylene Gas. Axel Renander. Acta Radiol., **18,** 688–692, October, 1937.

The author describes the case of a 15-year-old acetylene welder who, after work in an aluminum cylinder, suddenly collapsed with signs of marked dyspnea. The following morning, his sputum was blood-streaked and the roentgenogram showed irregular congestive changes in the lung parenchyma paracardially, together with a deposit of coarse patches in both lung-fields. The x-ray appearance suggested extensive bilateral bronchopneumonia. A control examination three days later showed a completely normal appearance of the chest. Noteworthy were the bronchopneumonic changes in this case of acetylene noxæ, since they contrast with the pulmonary changes after nitrous gas inhalation, which frequently resemble those present in miliary tuberculosis. The rapid disappearance of the phenomena is explained by the sterility of the pneumonic exudations and the relatively superficial character of the epithelial lesions.

ERNST A. SCHMIDT, M.D.

Typhoid Empyema: Report of a Case Operated upon and Cured. Alipio Correia Neto and José Finocchiaro. Ann. Paulist. de Med. e Cirurg., **34,** 545–554, December, 1937.

Neto and Finocchiaro report a case of left side empyema proven by cultures and blood agglutination to be due to Eberth (typhoid) bacillus. The writers believe this to be a case of typhoid pneumonia followed by empyema. Thoracotomy of the eleventh rib was done, followed by uneventful recovery.

A. MAYORAL, M.D.

OTITIS MEDIA

The Management of the Septic Patient with Otitis Media. J. H. Maxwell. Jour. Am. Med. Assn., **110**, 1536–1538, May 7, 1938.

The septic patient with otitis media may fall into one of three rather clearly defined groups. In the first group there is an infectious process, local or general, producing the clinical picture of sepsis antedating the otitis media. Unless a careful and detailed history is obtained the otologist may be led into performing a mastoidectomy or ablation of a sigmoid sinus when the source of the sepsis is extra-aural. This is particularly true in those cases of tonsillitis and suppurative sinusitis producing the picture of sepsis or even an actual septicopyemia in which an otitis media develops secondarily and contributes but little to the septic course. The second group of cases is that in which there develops during the course of an acute suppurative otitis media an intercurrent infection which in itself is responsible for the appearance of sepsis. Most common among these intercurrent infections are pneumonia and pyelitis. Erysipelas, rheumatic fever, endocarditis, coccic kidney or one of the acute exanthems may on occasion be found. The third group of cases represents those of real otitic sepsis in which the infection in the middle ear and mastoid is responsible for the whole picture. These cases require truly individualized management, both medical and surgical. If the roentgenogram reveals a diploic structure, the ear is a more likely source of the sepsis than if the mastoid were sclerotic or pneumatic type.

CHARLES G. SUTHERLAND, M.D.

PELVIC MEASUREMENTS

Roentgen-ray Pelvimetry. Charles Thomas Hayden. Calif. and West. Med., **49**, 25–29, July, 1938.

Dr. Hayden discusses the value of roentgen-ray pelvimetry and has classified the shapes of pelves under eight headings, finding four main types of female pelves. He lists his own method of grouping and what may be expected on delivery of the fetus with these various types of pelves. In his conclusions he states that there is no apparent correlation between the position and type of pelvis with regard to the incidence of operative interference, and that roentgen-ray pelvimetry is of valuable aid in determining the available space in any given pelvis but must be coupled with good clinical judgment for the conservative care of obstetrical patients.

JAMES J. CLARK, M.D.

X-ray Pelvimetry. A. Orley. British Med. Jour., 284–286, Aug. 6, 1938.

The author describes a simple method of obtaining a fairly exact measurement of the female pelvis roentgenographically by the use of a perforated plate such as is used in Thoms' method. The patient is placed on the x-ray film holder in a semi-reclining position (back support not described) so that the upper border of the symphysis is at the same level as the tip of the spinous process of the fourth lumbar vertebra. The exposure is then made and the patient removed without disturbance of the film or the x-ray tube. The perforated lead plate is then set over the film in the same horizontal plane as were the borders of the patient's pelvic ring. Another short-time exposure is then made which projects the perforations as black dots on the image of the pelvis. As the same roentgenographic distortion takes place, the dots become an exact measure of the diameters of the pelvic ring. The perforations being one centimeter apart, the dots can be read directly as centimeters

The calculated percentage of error by this method is negligible.

Q. B. CORAY, M.D.

PEPTIC ULCER

Peptic Ulcer Treated by Posterior Pituitary Extract. M. Hill Metz and Robert W. Lackey. Texas St. Jour. Med., **34**, 214–219, July, 1938.

The authors, noting that several cases of active duodenal ulcer were accompanied by an unexplained polyuria with nocturia, used posterior pituitary preparations, therapeutically, with satisfactory clinical results in 40 out of 42 unselected ulcer cases.

The intra-nasal method was found to be best. Forty milligrams, four times a day, was given by the patient to himself, 30 minutes after each meal and at bed time. No other treatment was employed. Reduced fasting gastric secretion and diminished muscular activity of the stomach was observed. The duration of the treatment averaged 28 days, but subjective improvement was present in from one to eight days. Three patients had recurrences, the second ulcer responding to the same therapy.

Following their observation over a period of two years, the authors conclude that posterior pituitary extract initiates and maintains, for a varying period of time, a condition in the upper gastro-intestinal tract conducive to the healing of duodenal ulcers.

JOHN M. MILES, M.D.

A Study of Peptic Ulcer Based on Necropsy Records. Sidney A. Portis and Richard H. Jaffé. Jour. Am. Med. Assn., **110**, 6–12, Jan. 1, 1938.

In a series of 9,171 consecutive necropsies performed at Cook County Hospital there were 457 cases of all types of peptic lesions, or a total incidence of about 5 per cent. The incidence of peptic ulcer in white persons was found to be 5.23 per cent, and in Negroes 3.5 per cent. The incidence of peptic ulcer is greater in the white male than in the white female; the difference according to sex is not as marked in Negroes. There was definite evidence of activity of the peptic ulcers in

339 necropsies. In 118 cases, peptic ulcer was the essential lesion; in 221, it was the incidental lesion. Therefore, the incidental lesion was almost twice as frequent. When peptic ulcer was the essential lesion the duodenal ulcer predominated, while, when peptic ulcer was the incidental lesion the gastric ulcer predominated. The peak for the incidence of peptic ulcer in the male is reached in the period from 51 to 60 years; the peak for the female is reached in the period from 31 to 40 years, while for the white female there is a second peak from 61 to 70 years.

Hemorrhage as a cause of death was observed in 0.43 per cent of all the necropsies and in 18.3 per cent in which peptic ulcer was seen as the essential lesion. Perforation was present in 20 per cent, and stenosis in 7.5 per cent, of all the cases (120) in which peptic ulcer was the essential lesion. Therefore, more deaths were due to perforation than to hemorrhage in cases of peptic ulcer. Hemorrhage was observed most frequently in the stomach and perforation most frequently in the duodenum.

The peak of the incidence for peptic ulcer coincides with the age period accompanied by arteriosclerotic changes; when peptic ulcer is the incidental lesion it is most often associated with cardiovascular disease.

The predominance of scars and the examination of the tendency to acuteness and chronicity showed that gastric ulcer tends to be acute while duodenal ulcer tends to be chronic.

CHARLES G. SUTHERLAND, M.D.

Peptic Ulcer of the Esophagus. J. Terracol, P. Lamarque, and Pierre Betoulieres. Jour. de radiol. et d'électrol., **22,** 182–187, April, 1938.

There are two main etiologic factors of peptic ulcer of the esophagus, namely, infection and acidity. Age is not important but the disease usually occurs in adults, equally in males and females. Alcohol is of questionable importance. The acid is due to regurgitation from the stomach because of an incompetent cardiac sphincter.

The findings are:

1. Location—in lower third of the esophagus.
2. Crater:
   (*a*) early, rounded or oval with smooth borders.
   (*b*) later, it assumes the appearance of a callous gastric ulcer with irregular borders.
3. Insidious onset.
4. Pain.
5. Regurgitation.
6. Dysphagia.
7. Hemorrhage.

The pain is epigastric or retrosternal and comes on shortly after eating. It is relieved by alkalies and has periods of exacerbation and remission. At first there is esophageal spasm but later there is stricture due to scar tissue. Hemorrhage may be occult or in the form of hematemesis.

The cure may be spontaneous but complications, such as perforation, sometimes occur and may be fatal.

The differential diagnosis is from high gastric ulcer, carcinoma, and cardiospasm. The x-ray signs are niche, spasm, and dilatation of the esophagus above the lesion if it develops slowly. Esophagoscopy and biopsy should be done if necessary to confirm or establish the diagnosis.

The treatment consists in removing any infection of the upper respiratory or upper digestive tract. Gastrostomy must be done if the patient is unable to eat.

Local applications of silver nitrate through the esophagoscope may be necessary and are beneficial. All irritating foods should be eliminated. Alkalies and larostidin are of value as in the treatment of gastric ulcer. If stenosis of the esophagus has occurred, dilatation is necessary.

A case report illustrating many of the features of this condition is presented.

J. SAGEL, M.D.

Multiple Ulcers of the Stomach and Duodenum. P. Savy, M. Girard, and Z. Khayat. Jour. de méd. de Lyon, **19,** 139–150, March 5, 1938.

Of a series of 96 surgical cases of peptic ulcer, the authors found the incidence of multiple ulcers to be 8.8 per cent. The association of duodeno-pyloric and lesser curvature ulcers is most common. The anamnesis is the same as for solitary ulcer, and multiple ulcers are not diagnosed clinically but radiologically. Radioscopy is most important but films also are necessary.

The ideal treatment is gastrectomy, removing both ulcers, although in some cases the procedure must be less radical.

S. R. BEATTY, M.D.

PERIRENAL INSUFFLATION

Perirenal Insufflation. William H. Mencher. Jour. Am. Med. Assn., **109,** 1338–1341, Oct. 23, 1937.

The procedure of perirenal insufflation was introduced by Carelli in 1921 as a means of obtaining better contrast between the kidney and the surrounding tissues. It has been of particular value in outlining the adrenals in cases in which these glands were suspected of hypertrophy or of newgrowth.

The technic of this procedure is explained in detail.

The method has been devoid of any untoward effects. In some instances there is complaint of fullness in the loin. In several cases, after sitting up the patient complained of a little pain in the shoulder corresponding to the injected side. This is indicative of the presence of air extraperitoneally under the diaphragm.

Immediate and late roentgenograms of the chest as a routine have revealed a positive mediastinal air outline in three of five cases. The pericardium is seen to be separated from the mediastinal pleura. This suggests that the perirenal insufflation may be used for the visualization of mediastinal lesions.

There is little difference except in the absorption time between air, oxygen, and carbon dioxide as the means

of gaseous contrasts. The three were used with equally good results.

CHARLES G. SUTHERLAND, M.D.

PITRESSIN

Several Cases of Radiography after the Injection of Pitressin: Experimental Proofs. P. C. Smyrniotis. Jour. de radiol. et d'électrol., **22,** 67–69, February, 1938.

The author finds that pitressin is of value in emptying the colon before radiography. The effect begins in five minutes, involving first the transverse, then the ascending and descending portions of the colon. It does not affect the sigmoid and rectum. The recommended dose of ten units is seldom sufficient: the author uses two doses of 20 units with an interval of 60 minutes. In the average patient there are no ill effects; there is a slight lowering of the blood pressure but no effect on the peristalsis of the gall bladder.

Pitressin can be used to advantage in radiography of the abdominal organs.

S. R. BEATTY. M.D.

RADIATION

The Problem of Potential in Deep Therapy. L. Graf and J. Graf. Strahlentherapie, **62,** 538, 1938.

The authors carried out a comparative study on roentgen rays produced at 200 and 400 kv. Apparatus, tubes, protection, and measuring instruments are briefly described. They state that the increase of output with the increase in potential does not justify the general use of higher potentials. Such an increase in output can be more economically obtained by increasing the tube current at 200 kv. The significance of higher voltages must be seen in the decrease in wave length. Optimal conditions may be obtained for 5 r/min. for 200 kv. at 60 cm. F.S.D. with a H.V.L. in Cu of 1.75 mm. and for 400 kv. with 6.5 mm. Important changes in the amount of back-scatter are found with decreasing wave length of the primary radiation. The amount of back-scatter is less for higher potentials and there is, of course, a marked softening of the scattered radiation with increasing potentials. The depth dose is definitely increased, especially for small areas at 60 cm. F.S.D. For a 50 sq. cm. area an increase from half value layer in copper of from 1.2 up to 7 mm. raises the depth dose from 30 to 36 per cent. The corresponding figures for 150 sq. cm. field are 39 and 44 per cent. Very important and quite remarkable is the drop in intensity for the first few centimeters below the surface. In practice, this means, of course, less absorption of radiation in normal tissue, which is a very desirable improvement.

ERNST A. POHLE, M.D., Ph.D.

Points of Mutual Interest to the General Practitioner and the Radiologist. W. A. Jones. Canad. Med. Assn. Jour., **39,** 152–157, August, 1938.

The author reviews radiological problems of interest to the general practitioner and the radiologist. In the examination of the lungs fluoroscopy alone is insufficient to detect incipient tuberculosis; even the film may fail to reveal an early lesion. In gastro-intestinal examination the radiologist depends more upon the fluoroscopic examination than upon the films, hence the inadvisability of arriving at a diagnosis from films alone. An examination of the gastro-intestinal tract should be made when the patient is sent for stomach symptoms. A plea is also made for sufficient time in which to conduct a proper examination. Too much reliance should not be placed on a fluoroscopic diagnosis in suspect fracture. When the fracture line is indistinct and there is practically no displacement of fragments, the diagnosis may be missed. After a fracture has been set or a dislocation reduced, a film should be taken invariably. The author stresses the fact that a radiodermatitis may be sustained by the practitioner who carelessly allows his hand to remain needlessly long under the fluoroscopic screen. In regard to radiotherapy, the radiologist must judge how and when treatment is to be administered.

M. L. CONNELLY, M.D.

The Spectral Distribution of a Heterogeneous Beam of Roentgen Rays. G. Grossmann. Strahlentherapie, **62,** 519, 1938.

In the author's opinion it is not advisable to plot spectral intensity distribution curves by using the wave length as abscissa. The potential at the tube should be given preference. Both methods, however, result in different energy maxima and show, in addition to the short wave limit, three characteristic geometrically defined points. A method is developed by which one may arrive at a uniform energy maximum and spectral energy distribution curve regardless of whether wave length or potential is used as abscissa.

ERNST A. POHLE, M.D., Ph.D.

RADIUM

Use of Radium in the Treatment of Uterine Fibroids. Louis Feid, Jr. Jour. Med., **19,** 415, 416, October, 1938.

Following an adequate description of the clinical manifestations of uterine fibroids, their classification and sequelæ, the author finds that the use of radium within the cervix gives the best results and he has abandoned all other means of treatment in uncomplicated fibroids of a size smaller than that of a six months' pregnancy. No technic or dosage is given.

JOHN B. MCANENY, M.D.

Radium Therapy of Carcinoma of the Cervix. K. Wasserburger and H. Smereker. Strahlentherapie, **62,** 584, 1938.

The authors studied the distribution of the radiant energy applied in carcinoma of the cervix according to the methods of Forssell and Heymann and of Regaud and Lacassagne. For their measurements they used the condenser dosimeter designed by Sievert. All doses

are expressed in r and in Imc. h.; 1 Imc. h. corresponds to approximately 8 r. The doses effective in the tumor itself were determined by carrying out measurements close to the radium screens without phantom. The amount of radiant energy reaching the parametrium, bladder, rectum, and lymphatics was measured on the cadaver. In order to avoid severe reactions in the mucous membrane the authors describe a modified method of inserting the vaginal radium applicator. They stress the importance of sufficient roentgen therapy in advanced cases of carcinoma of the cervix. If the dose of the preceding radium treatment is exactly known, the intelligent subsequent application of x-rays is greatly facilitated.

ERNST A. POHLE, M.D., Ph.D.

A Review of 20 Years' Radium Treatment of Lip Cancer at the Radiological Clinic, Lund, Sweden. Asta Bergendal. Acta Radiol., **19,** 103–125, May, 1938.

In the course of 20 years (1914–1934), 265 cases of cancer of the lower lip were treated at the Radiological Clinic of Lund. All cases received radium treatment. Prior to 1928, radium application by means of protheses was practised; since 1928, intratumoral intubation has been the method of choice. Metastatic tumor nodes were subjected to either x-ray or teleradium therapy. In some cases residual tumor nodes were extirpated.

Of the 181 operable cases, 153 (or 84.5 per cent) were free of symptoms after three years. The inclusion of the patients who died from intercurrent diseases would raise the percentage to 93.9 per cent. The corresponding five-year figures were 69.1 per cent and 90.8 per cent, respectively.

Of the 21 inoperable cases, 28.6 per cent were free from symptoms after three years, 25 per cent after five years. The inclusion of two patients who succumbed to intercurrent diseases would improve the three-year figure to 38.1 per cent and the five-year figure to 35 per cent.

For the entire number of cases, both operable and inoperable, the percentage of symptom-free cases for the three-year period is 78.7 per cent, or 88.1 per cent, respectively, and for the five-year period 63.9 per cent, or, considering the patients dead from intercurrent disease, 84.3 per cent.

These results confirm the claim advanced by radiologists that irradiation therapy of lip cancer must be considered superior to any other form of treatment.

ERNST A. SCHMIDT, M.D.

Hemorrhoids and Ano-rectal Angiomas in Infants. Alfred Bensaude and F. Bertillon. Arch. d. mal. de l'app. digestif, **28,** 181–197, February, 1938.

True hemorrhoids are rare in infants. Angiomas simulating hemorrhoids are found but are not common. Two such cases and a review of the literature are presented. In one of the authors' cases, radium therapy proved useless and, from the site of the lesion, might be very harmful.

S. R. BEATTY, M.D.

ROENTGENOGRAPHY, TECHNIC

A Comparative Study of Radiograms and Anatomical Sections of the Temporal Bone. Carl-Gustav Zachrisson. Acta Radiol., **19,** 55–66, March, 1938.

The author attempted to ascertain the best radiographic positions for the study of the temporal bone. Utilizing a technic advocated by Lysholm-Runström, he studied anatomic sections of decalcified petrous bones in various radiographic projections. The advantages and disadvantages of the three positions in most common use are discussed: the axial orthoprojection in lateral position, the semi-axial dorsal symmetrical projection, and the axial projection. Special attention is given to the appearance of the antrum. The semi-axial dorsal symmetrical projection supplemented by axial views gave the best possible information with regard to the porus internus and the apex.

ERNST A. SCHMIDT, M.D.

The Use of Prostigmin as a Preparation for Abdominal Roentgenography. Malcolm J. Farrell The New England Jour. of Med., **219,** 270–272, Aug. 25, 1938.

Following a description of the chemical derivation of prostigmin, its pharmacological action and experimental actions, the author discusses its various clinical applications and compares it to physostigmin.

Prostigmin was used to eliminate intestinal gas in abdominal roentgenography. Thirty-seven cases were studied by giving 2 c.c. of prostigmin (1:2000) the night before and repeated one-half hour before being subjected to abdominal roentgenography. Only two of the 37 films were classified as poor.

J. B. MCANENY, M.D.

The Differences between Radiological and Anatomical Measurements. Carl Wegelius. Acta Radiol., **19,** 185–204, May, 1938.

As expressed by the sub-title of the article, this publication represents "a study of roentgenographical contours, with special reference to the precision of different measuring methods and the prospects of their development." The author points out that the shadow projections as seen in roentgenograms may be misleading both with regard to size and shape. Consequently, marked differences between radiological and anatomical measurements may ensue. While errors due to the divergence of the rays (shadow enlargements) may be calculated and corrected with a fair degree of accuracy, effects due to the obliquity of the object to the picture plane (shadow distortions) are not amenable to such correction. The various possibilities for errors in localization and measurements are discussed, and a process of three-dimensional projection is described by which the misleading shadows (by means of convergent optical projection) are changed into "real sections" assuming the anatomical shape and size of the contour parts.

Though technical to a large degree, Wegelius' article is worthy of being read and studied in the original text

by any radiologist interested in this special phase of roentgenology.

ERNST A. SCHMIDT, M.D.

SEMINAL VESICLES

Retrograde Catheterization in Diagnosis and Treatment of Seminal Vesiculitis. Andrew P. Peterson. Jour. Urol., **39,** 662–677, May, 1938.

After examination of 75 patients the author concludes: the vesicle fills first, the ampulla next, and the vas deferens last. There are no valves in the ampulla and there is no tonic closure of the ampulla. Dilatation of the ejaculatory ducts or the seminal tract should be followed by ejaculation in two or three hours in order to promote drainage and to prevent epididymal complications. Vesiculograms made with suitable contrast material, reflect the size, shape, and structure of the seminal vesicles, as well as the relative topography of the ampulla and vas deferentia. Improvement in the drainage and structure of the seminal vesicles is proven roentgenographically.

JOHN G. MENVILLE, M.D.

THE SPINE

Acute Infective Osteomyelitis of the Spine. Philip Turner. British Jour. Surg., **26,** 71–85, July, 1938.

Acute osteomyelitis of the spine has been regarded as a very uncommon as well as an often fatal disease. However, if cases of less severity are included, the disease is not so infrequent as revealed by the recent increase in the number of reported cases. The author reviewed rather scarce literature on the subject and was particularly impressed by a fairly recent paper by Jacob Kulowski who reported 102 cases, and who pointed out that more discriminating diagnosis has resulted in a surprising increase in the frequency of the disease.

The author has based his paper on 12 case reports, divided into two groups. In five cases the inflammatory process had extended into the spinal canal with symptoms of cord involvement. In seven cases a definite diagnosis of osteomyelitis of a vertebra was definitely diagnosed. Six of these cases had roentgenographic examination with positive findings, one case showing osteitis with necrosis involving the twelfth dorsal and the first and second lumbar vertebræ. The diagnosis was confirmed in the remaining cases by operation or autopsy findings.

Etiology.—The incidence of osteomyelitis of the spine is 1.5 per cent of all cases of osteomyelitis of all bones. The dorsal and lumbar vertebræ are most frequently affected. A history of boils, insect bite, septic finger, or of a sore throat, is frequently noted. Occasionally there is a history of a chronic staphylococcal septicemia with localized infections of bones at longer or shorter intervals (two of the author's cases).

Pathology.—1. The focus is usually of small size. In the dorsal and lumbar regions the posterior arch and processes are commonly attacked in the cervical region of the body. 2. Usually only one vertebra is involved. 3. Sequestra are not constant and small when present. 4. Involucrum does not occur and is never demonstrable by x-ray examination.

Bateriology.—The infecting organism is nearly always the *Staphylococcus aureus,* but occasionally other organisms, especially hemolytic streptococci, have been found.

Complications.—Suppuration is frequent and the symptoms are usually those of abscess rather than the bone lesion. In the dorsal region the pus extends into the mediastinum and may involve the pleura or lung. Involvement of the lumbo-sacral spine and coccyx will produce suppuration in a variety of locations according to vertebræ involved. Urinary infection is frequent and was present in five of the author's cases. Extension of inflammation to the spinal canal and cord is comparatively infrequent and when it does occur it has confused the diagnosis with that of transverse myelitis, anterior poliomyelitis, and cerebrospinal meningitis.

Diagnosis.—The diagnosis will always depend on making every effort to determine the origin of a perinephritic, retropharyngeal, ischiorectal, psoas, or subphrenic abscess. Roentgenological examination is of little value in early diagnosis because the focus is small, deeply placed, and beneath large muscles. X-ray evidence is found late in the course of the disease. Areas of increased density and any abnormality of the intervertebral space should be carefully noted. A lesion in the spinous or transverse process can usually be detected while a focus in the laminæ or pedicles is generally unrecognized.

Prognosis.—The mortality varies from 25 to 50 per cent in all reported cases from the literature. The prognosis depends on the location of the abscess and its accessibility to surgical drainage and will vary according to the proximity to important structures and organs. A lesion in the body or on the anterior aspect of the transverse process is likely to extend to the mediastinum, perinephric region, or spinal canal, with a correspondingly high mortality.

Treatment.—Treatment consists of surgical drainage of the abscess. No attempt should be made to open or remove any bone unless some loose fragment or sequestrum should be felt. When there are symptoms of a spinal cord lesion a decompression operation should give a chance for recovery although it has seldom been performed.

MAX CLIMAN, M.D.

Pathologic Conditions of the Spine: Painful Disturbances of the Intervertebral Foramina. Lee A. Hadley. Jour. Am. Med. Assn., **110,** 275–278, Jan. 22, 1938.

Two distinct types of pathologic changes in the intervertebral disks are encountered. In early life herniations of the nucleus pulposus may take place either through a break of the cartilaginous plate into the substance of the vertebral body, or through the annulus fibrosus into the spinal canal. In the type of change

which occurs in later life, fragmentation of the cartilaginous plates allows granulation tissue to grow from the adjacent vertebral bodies into the disk. Here it replaces the nucleus pulposus, so that finally the disk becomes merely fibrous tissue or even bone.

Thinning allows the bodies to approach each other, so that apophysial subluxation or slipping of the posterior joints may result. Pain may be caused by bony impingement of the tips of the subluxated articular processes or by constriction of the intervertebral foramina. Extreme lordosis favors subluxation of the posterior joints. Bony exostoses in the midcervical region produce encroachment of the foramina. Angulation of the cervical part of the spine is traumatic. Fusion of adjacent segments of this portion of the spine is common and may be congenital or acquired. The symptoms are both local and referred.

CHARLES G. SUTHERLAND, M.D.

Anomalies of the Spine. Wilbur Bailey and Ray A. Carter. Calif. and West. Med., **49,** 46–51, July, 1938.

The authors discuss anomalies of the spine, bringing out the fact that at least 67 per cent of spines show variations from normal. They discuss embryonal development, and under separate headings discuss the various common anomalies. In this day of frequent injury to the spine, with both compensation and civil suits, it is important that all roentgenologists be familiar with types described in this excellent paper.

JAMES J. CLARK, M.D.

Radiculo-medullary Compression in the Course of Malignant Granulomatosis. J. Froment, P. Croizat, and R. Masson. Jour. de méd. de Lyon, **19,** 71–86, Feb. 5, 1938.

Radiculo-medullary compression in the course of malignant granulomatosis is not common but is far from exceptional; occurring usually from destruction of the vertebral bodies, less frequently from invasion of the meninges, and least often from invasion of the spinal cord itself.

The symptoms are those of medullary compression. The localization is discussed by the authors in some detail. It is most frequently cervical or thoracic. The presence of adenopathy, particularly of the mediastinum, supports the diagnosis, biopsy confirms the diagnosis. Radiotherapy, rather than surgery, is the treatment of choice. Marked amelioration of symptoms is usual but the course of the disease is not changed. In the authors' case, a respite of four years was obtained.

S. R. BEATTY, M.D.

Schmorl's Cartilage Islands. Kristian Overgaard. Acta Radiol., **19,** 143–150, May, 1938.

The author reports three cases of Schmorl's cartilage islands which, both clinically and roentgenologically, offered considerable differential diagnostic difficulties and were very similar in appearance to changes seen in tuberculous spondylitis. The x-ray film shows a defect in the body of the vertebra, combined with narrowing of the intervertebral space. Slight sclerosis of the adjoining joint surfaces and reactive changes at the edges of the latter may also be present. As a rule, changes in tuberculous spondylitis are more extensive and less clearly limited than in cases of Schmorl's islands, in which abscess formation or vertebral collapse is absent. However, Schmorl's islands are frequently encountered in juvenile kyphosis with marked deformity of the spine. The subjective symptoms may be pronounced, and a relation to the development of deforming spondylitis or of juvenile kyphosis (Scheuermann's disease) is possible.

ERNST A. SCHMIDT, M.D.

THE STOMACH

A Gastric Lesion Produced by Posterior Pituitary Extract. M. Hill Metz. Texas St. Jour. Med., **34,** 295–297, August, 1938.

The author experimentally produced in 28 rabbits a constant lesion of the stomach by the administration of 25 international units of posterior pituitary extract per kilogram of body weight.

Twenty-four hours after injection necrosis, hemorrhage, and ulceration were present, sharply limited to the fundus of the stomach. This lesion was not similar to peptic ulcer in man, and one need feel no concern in administering this extract since the amount given was many times the maximum therapeutic dose.

The same dose in dogs inhibited for four hours or more the gastric secretion in response to histamine stimulation and produced in 24 hours gastric lesions similar to those produced in the rabbits.

JOHN M. MILES, M.D.

Volvulus of the Stomach. P. Chêne and M. Ramadout. Arch. d. mal. de l'app. digestif, **28,** 433–467, May, 1938.

Volvulus of the stomach may be defined as a torsion which causes the whole or a part of the posterior surface of the stomach to become anterior. This applies to two types of volvulus—volvulus on the longitudinal or organic axis, and volvulus on the transverse or mesenteric axis. The former may be partial or complete. The latter is always complete. The term "segmentary" is preferable to the term "partial," as the latter term pertains better to the degree of rotation.

The clinical diagnosis is impossible except in certain cases of acute volvulus. Operative confirmation of this condition has been made in only four cases. Radiologic examination is useless in the acute form except to demonstrate that no barium enters the stomach. In chronic volvulus, the information derived may be confusing or misleading.

Volvulus on the longitudinal axis may be associated with intestinal pneumatosis or with perigastric infiltrations or adhesions due to ulcer or syphilis. Volvulus on the transverse axis may be due to shortening of the lesser curvature from epiploitis caused by ulcer, but in many, if not all, cases atony of the diaphragm is the major factor.

The treatment may be medical, which rarely effects complete cure, or surgical with a mortality of almost 50 per cent.

S. R. BEATTY, M.D.

The Influence of Pituitrin on the Evacuation of the Stomach. R. I. Levina. Eksperimentalna Meditsina (Ukrainian), **2,** 65–70, 1938.

Basing her conclusions on animal experiments (dogs), the author claims that the common theories of a stimulation of gastro-intestinal function by small doses of pituitrin and of a corresponding inhibition of function by large doses call for correction and modification. In her experiments, small doses had an insufficient and uncertain effect, while the inhibitory effect of large doses was confirmed. These experiments showed, further, that, with regard to gastric evacuation, pituitrin is antagonistic to insulin, and synergistic to adrenalin. An exact evaluation of the dosage employed is made impossible by the fact that the used preparation (brand "R," furnished by the Moscow Endocrinological Institute) cannot be compared with any preparation available in this country, as demonstrated by the unusually large doses possible (0.08–0.3 c.c. per kilogram of body weight for "small doses" and 0.4–0.6 c.c. per kilogram of body weight for "effective" doses).

ERNST A. SCHMIDT, M.D.

Gastroscopic Studies. Ernest H. Gaither and James L. Borland. Jour. Am. Med. Assn., **110,** 436–438, Feb. 5, 1938.

The authors present their impressions derived solely from gastroscopic studies. Gastric mucosa is normal when it is unblemished, smooth, glistening, translucent, and orange-red, similar to the normal mucous membrane elsewhere in the body. Most healthy persons have this type of gastric mucous membrane, which varies surprisingly little in appearance. Gastroscopically, in the gastric mucosa of healthy, fasting subjects, small red streaks are occasionally observed which are quite easily recognizable as being due to irritation from passage of the tube. Another abnormality in otherwise normal-appearing stomachs is submucosal hemorrhage, varying from the size of a pea to several centimeters in diameter and protruding from the gastric wall. The authors saw these hemorrhages in probably 7 per cent of the cases, located in areas where it was certain there was no trauma due to the instrument. These occur in stomachs in which hemorrhage along the course of the instrument is observed. The authors believe that these hemorrhages mean increased friability; they know that they seem to cause severe pain at times, yet they are not prepared to make any statement as to their significance.

There are several good working classifications of gastritis, the simplest being that of Schindler, with its three divisions of superficial, hypertrophic, and atrophic. The authors discuss in detail their difficulties in fitting many cases to existing classifications.

CHARLES G. SUTHERLAND, M.D.

THE THYMUS

A Study of the Relations between Birth Weight and Size of the Thymus Shadow in 2,000 New-born. S. W. Donaldson. Ohio St. Med. Jour., **34,** 538–541, May, 1938.

In a study of 2,000 unclassified newborn infants 18.4 per cent showed some roentgen evidence of thymic enlargement and 11.5 per cent were definitely so. The technic used included anteroposterior and lateral views in the supine position taken by the same technicians with rapid exposure at 30 in. distance (the author does not state which phase of respiration was taken). Standards of interpretation were: any mediastinal width of the third thoracic spine level above 3.5 cm. with associated displacement or buckling of the trachea was definitely positive; widths between 3.0 and 3.5 cm. were considered borderline.

The percentage of enlargement is higher in the heavier babies and in the males. Therapy was given in all (including borderline) cases with no ill effects. The factors used were 100 r, 130 kv.p., 4 mm. Al filter. One treatment was usually sufficient. In cases of definite enlargement from two to four such treatments were given at weekly intervals and the cases were followed roentgenographically. Of the 193 cases in 1,000 male infants and the 175 in 1,000 females, all showed reduction in size of the thymus following x-ray therapy and none showed evidence of ill effects. No thymic death was cited in the records of any of these cases.

SIMON POLLACK, M.D.

TUBERCULOSIS, PULMONARY

Tuberculosis of Intestines in Tuberculous Anthracosilicosis. Robert Charr and Archibald C. Cohen. Am. Jour. Med. Sci., **196,** 83–88, July, 1938.

In view of the high percentage of tuberculosis in anthracosilicosis (56.7 per cent as determined clinically, and 86 per cent determined at postmortem) it was of interest to study the incidence of intestinal tuberculosis in the combined diseases. The material consisted of 42 cases of anthracosilico-tuberculosis and 75 cases of nonsilicotic pulmonary tuberculosis as determined at autopsy.

Of the 42 cases of anthracosilico-tuberculosis, six of which were under 30 years of age, 19 per cent had intestinal lesions; four of the six younger patients were so afflicted. Arranged according to the extent of the silicosis, 43 per cent of the early and moderately advanced types had intestinal lesions, whereas only 7 per cent of the far-advanced type were so complicated.

Among the 75 cases of non-silicotic pulmonary tuberculosis, 53 per cent of those under 30 years of age and 47 per cent of the older group had intestinal lesions.

The acute, caseous, tuberculous lesions predominated as complications of silicosis. In only one case

of far-advanced silicosis did the tuberculosis occur in the minimal stage; in all others it was far-advanced and excavated.

In both anthracosilico-tuberculosis and nonsilicotic pulmonary tuberculosis the incidence of intestinal lesions is higher in the younger age groups. But age alone is not a determining factor. Although the incidence of pulmonary tuberculosis increases with the increase in anthracosilicosis, intestinal tuberculosis in far-advanced anthracosilico-tuberculosis is rare. This is probably due to the pulmonary fibrosis and the chronicity of the tuberculosis. The cavity, when it forms, enlarges very slowly. The material within it contains few, if any, bacilli. Furthermore, the blood vessels undergo extreme sclerotic changes.

The amount of intestinal tuberculosis, when it occurred, was great, often involving the entire ileum, the cecum, and other parts of the colon.

The majority of the patients with intestinal tuberculosis gave no symptoms referable to the abdomen.

BENJAMIN COPLEMAN, M.D.

Radiological Study of Spontaneous Rib Fracture among the Tuberculous. Carlo Sabbione. Radiol. Med., **25**, 528–541, June, 1938.

The author studied the behavior of spontaneous rib fracture among patients afflicted with pulmonary tuberculosis. He reviews 10,304 chest films made on 4,570 patients, and finds that these fractures occur more often among the aged and exclusively among those suffering from a virulent form of tuberculosis, and that it is not extremely rare.

The actual cause of the injury is the cough and the weakened condition of the patient. The predisposing cause is bone decalcification due to poor calcium fixation.

A. MAYORAL, M.D.

Certain Significant Aspects of Childhood Tuberculosis. Ralph M. Tyson. Jour. Am. Med. Assn., **109**, 753–755, Sept. 4, 1937.

No other communicable disease equals tuberculosis in the taking of human lives. It probably exceeds all other diseases in individual and social importance, not so much from what it does to the child during the first infection as because of what it means to the individual during and after adolescence, when reinfection occurs. The pathology of a first infection and the source of most reinfections are more clearly understood now than ever before. Early diagnostic signs are very indefinite and frequently missed, until there is evidence of extension of the disease.

At the present time it is believed that most tuberculous infections are air-borne and gain entrance into the human body by way of the pulmonary structures. The tubercle bacilli are inhaled and lodge in the terminal bronchioles and alveoli. The size of the dose of the infecting organisms, the multiplicity of its repetition, and the amount of the local tissue resistance are all determining factors in the spread of the disease. Wherever the organisms lodge they form the typical miliary tubercles and may proceed through the several stages of fibrosis, calcification, or dissemination. Because in the young child the lymph channels are almost completely uninterrupted, tubercle bacilli are apt to pass more rapidly towards regional and distant lymph nodes. The lymph nodes themselves in the young child are poor filters; hence some of the organisms pass through them and may eventually reach the blood stream for generalized distribution of the infection. The less pervious pulmonary lymphatic system of the adult causes arrest of the bacilli out in the lung, and the tuberculous focus develops at the point of this arrest.

This early pathologic condition is commonly spoken of as a primary complex and consists of the area of first penetration of the pulmonary structures, the lymphangitis along the pathways, and the lymphadenitis. The dissolution of the lipoid capsule of the tubercle bacillus permits of the liberation of tuberculoprotein. It is with the liberation of this substance that the tissues of the patient are sensitized and clinical symptoms are more apt to be recognized. Positive tuberculin tests may be secured at the end of this period, which may have lasted from three to six weeks.

The time between the primary and reinfection types of tuberculosis may extend from a few months to many years. Usually the first chapter in this history ends with securing a positive tuberculin test, without palpably evident clinical, pathologic, or x-ray changes. Clinical signs are most indefinite during this period.

During the second chapter in the history of the disease there is usually definite clinical, pathologic, and x-ray evidence of reinfection and expansion.

Reinfections are the result of an exacerbation of a primary infection caused by the rupture of a lymph node or parenchymal tubercle into a new lymph node, a bronchus, the blood or lymph streams, resulting from softening of caseous nodules, the enormous reproduction of bacilli in the several forms of their development, and their subsequent rupture.

The best known stage of tuberculosis represents the third chapter in its life history. This is the very active stage of the disease and most often occurs when the child is no longer a child. It is known to exist in the very young infant and may involve nearly any organ in the body.

The question of whether the primary infection is an asset or a liability is contested very earnestly by several groups of workers.

In the diagnosis, serial x-ray studies have helped greatly and are of far more value than a single x-ray study.

The most efficacious procedure in preventing tuberculosis in infants and children is to keep them from coming in contact with open cases of the disease.

The full elimination of tuberculosis will depend to a large extent on finding out the ones that are already infected. Active physical examination of all children attending school must be universal if such a hope is to be realized. The examination in most instances will fail to reveal definite signs of early tuberculosis in the child's chest, so it will be necessary to include the

tuberculin testing of all school children and serial x-ray studies of their chests for all positive reactors.

CHARLES G. SUTHERLAND, M.D.

The Effects of Pentothal Sodium on the Electrocardiogram of Patients with Essential Hypertension. C. J. Betlach. Proc. Staff Meet. Mayo Clinic, **13,** 189–191, March 23, 1938.

Forty-four hypertensives were studied, their ages ranging from 21 to 56 years. The electrocardiograms of 15 of these patients were normal. Those of the remaining 29 showed evidence of cardiac damage. Leads I, II, and III were recorded before the operation, Lead II during the period of induction, and just prior to discontinuing the anesthetic Leads I, II, and III were again recorded.

The following results were noted: The P-wave amplitude increased from 0.25 to 2.0 mm.; the T-wave amplitude decreased to the extent of 0.5 to 2.0 mm. The changes produced were not regarded as being caused by a great decrease in blood pressure, but were most probably due to anoxemia as a result of decreased respiratory excursion. The author emphasizes the fact that the presence of dyspnea is a contra-indication to the use of pentothal sodium.

W. H. GILLENTINE, M.D.

The Necessity of Systematic Use of Barium Enemas to Disclose Latent Intestinal Tuberculosis in Cases with Pulmonary Tuberculosis. M. Picard. Bull. et mém. Soc. de Radiol. méd. de France, **26,** 258–264, April, 1938.

Intestinal tuberculosis occurs more frequently than is supposed, often when evidences of pulmonary tuberculosis are slight. A lack of parallelism between a satisfactory status of the pulmonary condition and a poor general condition should lead one to suspect intestinal involvement. The diagnosis may be confirmed by the use of a barium enema, with, possibly, inflation with air. The diagnosis is of interest, as the condition is susceptible of cure.

S. R. BEATTY, M.D.

TUBERCULOSIS, RENAL

Has Excretory Urography Replaced Retrograde Pyelography in the Diagnosis of Renal Tuberculosis? John L. Emmett and William F. Braasch. Jour. Urol., **40,** 15–23, July, 1938.

In more than two-thirds of 100 consecutive cases of proved renal tuberculosis the problem was determining the degree of involvement of each kidney.

Excretory urography is becoming more important in this field of diagnosis and is supplanting retrograde pyelography in a large percentage of cases. However, retrograde pyelography is still of importance in differential diagnosis in a small group of cases in which the disease itself is in doubt or in an occasional case in which the lesion is exceedingly small and circumscribed.

As a result of excretory urography, repeated cystoscopic examinations should be entirely unnecessary. It is questionable practice to advise nephrectomy on data furnished by excretory urography alone. The best procedure to follow is a combination of excretory urography plus microscopic examination and staining the specimen of urine obtained by catheterization of the ureter of the so-called good kidney.

The most common findings seen in the excretory urogram of the tuberculous kidney, in order of their frequency, are: (1) no visualization; (2) delayed visualization; (3) caliectasis; (4) evidence of necrosis in the outline of the calices; (5) cicatricial deformity of calices and "pinching off" of the tips of the minor calices or obliteration of the calices; (6) deformity or dilatation of the ureter, and (7) pyelectasis.

JOHN G. MENVILLE, M.D.

TUMORS (DIAGNOSIS)

Calcification in Angiomas. F. Y. Khoo. Chinese Med. Jour., **53,** 127–140, February, 1938.

Seven cases of angioma, in which phleboliths were demonstrated roentgenologically, are presented and a concise history of phleboliths in general is given. In this series the calcification occurred four times in the neck—three times on the right side, and once on the left—and once in each of the following regions: right knee, right hand, and left middle finger.

In angioma, the roentgenologic appearance of phleboliths in typical cases is characteristic. A homogeneous central shadow is surrounded by concentric rings of opacity and translucency. The number of phleboliths is unlimited—over 130 were present in the first case of the author's series.

In making the differential diagnosis the following conditions must be considered: calcified parasites, hematoma, granuloma, or any small tumor of the skin, osteoma, neuroma, myositis ossificans, and calcinosis.

In his summary the essayist states that the incidence of phleboliths in angioma is about 2 or 3 per cent, and that a soft tissue tumor showing the characteristic calcified nodules on x-ray examination can be safely diagnosed as an angioma with calcifications.

A. MAYORAL, M.D.

The Anterior Basal Meningiomas. W. R. Henderson. British Jour. Surg., **26,** 124–165, July, 1938.

Meningiomas occur most frequently in regions of dural venous sinuses, both over the convexity, especially in the parasagittal region, and on the skull base. The basal meningiomas, because of their close relationship to the cranial nerves, give an entirely different clinical picture from the other types of tumor. The important extra-cerebral signs are (1) those of cranial nerve involvement and (2) changes in the bone overlying the dural attachment. Roentgenographic evidence of the latter, chiefly hyperostosis, erosion, and increased vascularity of the bone, can be detected with certainty in many cases. The majority of basal menin-

giomas lie in relation to the anterior and middle cranial fossæ.

The olfactory groove meningiomas are usually attached to the dura covering the cribriform plate of the ethmoid. Loss of the sense of smell and optic atrophy, as the tumor expands, are two important symptoms. The author reports three cases, two of which gave x-ray evidence. In one case there was a definite dense hyperostosis on the floor of the anterior fossa and disappearance of the cribriform line. In the second case there was suggestive evidence of erosion. In two of the three cases the tumor was successfully removed and the third patient died several hours after operation.

The meningiomas of the tuberculum sellæ are midline tumors situated between the optic foramina. They produce bitemporal hemianopsia and primary atrophy. The x-ray evidence is not remarkable and consists chiefly of a shortened dorsum sellæ and flattening from above.

The sphenoid ridge meningiomas are divided into two groups: (1) those attached to its inner part which is formed by the lesser wing of the sphenoid and (2) those attached to the outer part of the ridge. The former produce early involvement of one optic nerve while the latter produce symptoms of increasing intracranial pressure. Roentgenographic evidence consists of hyperostosis on the upper surface of the lesser wing at the base of the anterior clinoid process, absence of one anterior clinoid, enlargement of neighboring foramina, and destruction of surrounding bone. The various changes require special views including stereoscopic films of the orbits and special views of the optic canal. The outer sphenoid ridge group of meningiomas are characterized chiefly by headaches and transient blindness. Roentgenographs frequently demonstrated signs of increased intracranial pressure but localized changes were unusual. Ventriculography had to be resorted to in these cases for diagnosis and localization.

The author includes the reports of six cases of meningioma which were operated upon; four made good recovery and two died. A total of 45 cases has been reviewed. Twelve cases of olfactory groove meningiomas were studied all of which had loss of sense of smell and roentgenographic evidence was not constant. Thirteen examples of tuberculum sellæ tumors are summarized, all showing the well-known syndrome of progressive bitemporal hemianopsia with primary optic atrophy and a normal sella. The presence of x-ray evidence was exceptional. The remaining cases were the sphenoid ridge tumors with x-ray evidence only in tumors at the inner end.

MAX CLIMAN, M.D.

A Classification of Tumors. Lawrence A. Pomeroy. Ohio St. Med. Jour., **34,** 1015–1018, September, 1938.

Note: This classification was carried in installments in the five issues May–September, 1938.

The author has presented a complete classification of all types of tumors, both benign and malignant, of all the body structures with acknowledgment of the work of Ewing, Karsner, Geschickter, and Willis. Nomenclature has been standardized as much as possible and synonymous or proper names are also given in many cases. The arrangement includes every possible structure in the body. The tumors are classified in the order of physiological tumors, benign, malignant, and lastly, unusual types, or types of a character peculiar to the specific structure involved.

As regards the details of specific tumors the classification appears to follow the latest reports of the current literature. For example, the malignant tumors of the testis follow Ferguson's arrangement in terms of differentiation of the tumor cells as evidenced by the Aschheim-Zondek test; brain tumors closely follow the Bailey-Cushing classification; bone tumors follow the classification of the Registry of Bone Tumors; "fibrosarcoma" (extraperiosteal fibrosarcoma) has been reclassified as neurogenic sarcoma in view of its origin from sheath of Schwann cells; glomus tumor has been accurately classified as a miscellaneous type of neuromyo-arterial tumor.

SIMON POLLACK, M.D.

On Tumors of the Upper Pole of the Stomach. Bo Stenström. Acta Radiol., **19,** 4–11, March, 1938.

The author emphasizes the difficulties encountered in the diagnosis of these tumors which, in his experience, made up about 13 per cent of gastric cancers. While often entirely obscured by the ordinary barium meal these tumors can, as a rule, be visualized as soft tissue proliferations in contrast to the gas bubble of the gastric fornix (*"Magenblase"*). This contrast may be enhanced by enlargement of the gas bubble by means of a drink of effervescent water. Occasionally an increased distance between gas bubble and lung field point to a lesion. The deformity of the gas bubble may amount to complete obliteration of the bubble in the case of large tumors. Dilatation of the esophagus is an unreliable diagnostic sign. The tumors may be solitary or multiple, of a polypous nature, or of more evenly infiltrating character.

ERNST A. SCHMIDT, M.D.

Cystic Hygroma of the Neck. Bruce L. Fleming. Jour. Am. Med. Assn., **110,** 1899, 1900, June 4, 1938.

A hygroma is a thin-walled cystic tumor containing lymph and lined with endothelium. It occurs most commonly in the side of the neck in the lower half. Occasionally it extends into the mediastinum. These tumors are usually made up of several cysts and are then described as lobulated. Capillary and cavernous types, however, occur in children. Hygromas also have been found in the axilla and groin, but these are rare. Hygromas of the neck appear most frequently during the first two years of life, but they may develop at any time. They grow rapidly.

It seems quite definitely established that hygromas grow from the lymph sacs known to appear in the neck in the embryologic development of the lymphatic sys-

tem. The origin of these lymph sacs is still a matter of controversy.

Cystic hygromas have very thin walls of fibrous tissue lined with endothelium, which is readily stained with silver nitrate so that the cellular arrangement may be seen. These lining cells differ from the endothelial cells which normally line lymphatic capillaries. The latter are usually thinner. They do not differ structurally from the endothelial cells lining the main group of blood capillaries.

The function of the lining endothelium of lymph capillaries is essentially absorptive and that of the blood capillaries is both productive and absorptive. In hygromas the lining cells seem to resemble functionally the endothelium of blood capillaries, for in all probability they produce the lymph which fills the cysts. No other source has been determined. This lymph may be tinged with blood, though it is usually straw-colored. Rudimentary forms of lymph "gland" tissue containing both lymphatic capillary network and blood vascular tissue is sometimes found attached to hygroma colli. This lymph gland tissue develops from plexuses of lymph vessels. The phagocytic power of lymph gland tissue is well known. Evidence, however, of the phagocytic power of lymph vessel endothelium is negligible.

Hygromas usually do not give rise to troublesome symptoms other than those of tumor. They may grow to considerable size in infants and children and thus cause marked dyspnea. They have been mistaken for branchial cysts, lipomas, tuberculous glands, lymphangiomas, lymphomas, and carotid tumors. Hygromas of the neck are usually lobulated and appear on the side and usually in the lower half of the neck. They are not attached to the skin but rather to the deep structures.

Treatment is complete surgical excision. If the tumor extends into the mediastinum, partial excision and packing may be done with excellent results. Radium treatment has been tried in children. Aspiration and injection with sclerosing solution have not proved satisfactory.

CHARLES G. SUTHERLAND, M.D.

ULTRA-VIOLET LIGHT

The Effect of Ultra-violet Rays on the Vitamin C Content of Milk. Hermann Schroeder. München. med. Wchnschr., **84**, 1942, 1943, Dec. 3, 1937.

The author studied the destruction of vitamin C in milk, fruit pulp, and watery solution by ultra-violet rays. Adequate controls were provided by irradiation with an ordinary electric light. The irradiated solutions were in 3–5 mm. sheets and held at 0° C. Destruction of the vitamin occurred in all these media, but the amount of ray needed to produce corresponding degrees of destruction differed in different media. Only a reversible oxidation of the vitamin occurs, however.

LEWIS G. JACOBS, M.D.

Ultra-violet Therapy: Several New Sources of Radiation, Their Mechanism of Action and Clinical Indications. E. Biancani and H. Biancani. Jour. de radiol. et d'électrol., **22**, 70–73, February, 1938.

The authors discuss the various sources of ultra-violet radiations used in modern practice, their physiologic effect and the technic of irradiation in various diseases including rickets, surgical tuberculosis, skin diseases, pain, and circulatory disturbances, and states of hypofunction, such as asthenia, organic deficiencies, impaired metabolism, etc.

S. R. BEATTY, M.D.

VENOGRAPHY

Venography in a Case of So-called Traumatic Thrombosis of the Axillary Vein. Olof Andersson. Acta Radiol., **19**, 126–134, May, 1938.

The author discusses the possibilities and limitations of venography both in general and with regard to his special case of "traumatic thrombosis" of the axillary vein. Strictly speaking, this term is a misnomer since in no case could a thrombus be found on operation. Therefore, the name suggested by Löhr (intermittent venous claudication) might be considered preferable.

The etiology of the disease is not clear; trauma itself can only activate the symptoms. The author's case was observed in a 26-year-old office worker in a library who, after the putting up of books a few months previously, developed a swelling of the left arm, combined with a feeling of heaviness and a marked prominence of the superficial blood vessels of the upper arm and axilla. Venography effected by injection of urographic contrast medium into the cubital vein revealed irregular contours of the axillary vein. In addition, the radiopaque solution outlined a well-developed collateral vessel along the lateral thoracic wall, the lateral thoracic vein, and several costo-axillary veins. The roentgenogram indicated an obstruction of the axillary vein of unknown origin. The symptoms disappeared almost completely after rest and application of heat but the filling of the collateral vessels could be demonstrated in a later venogram, thus proving the persistence of an obstruction to circulation in the axillary vein.

The author mentions that in two other cases of similar symptoms traumatic thrombosis could be excluded and the correct diagnosis (carcinoma blocking the lymphatics and a cervical rib syndrome, respectively) was facilitated by means of venography

ERNST A. SCHMIDT, M.D.